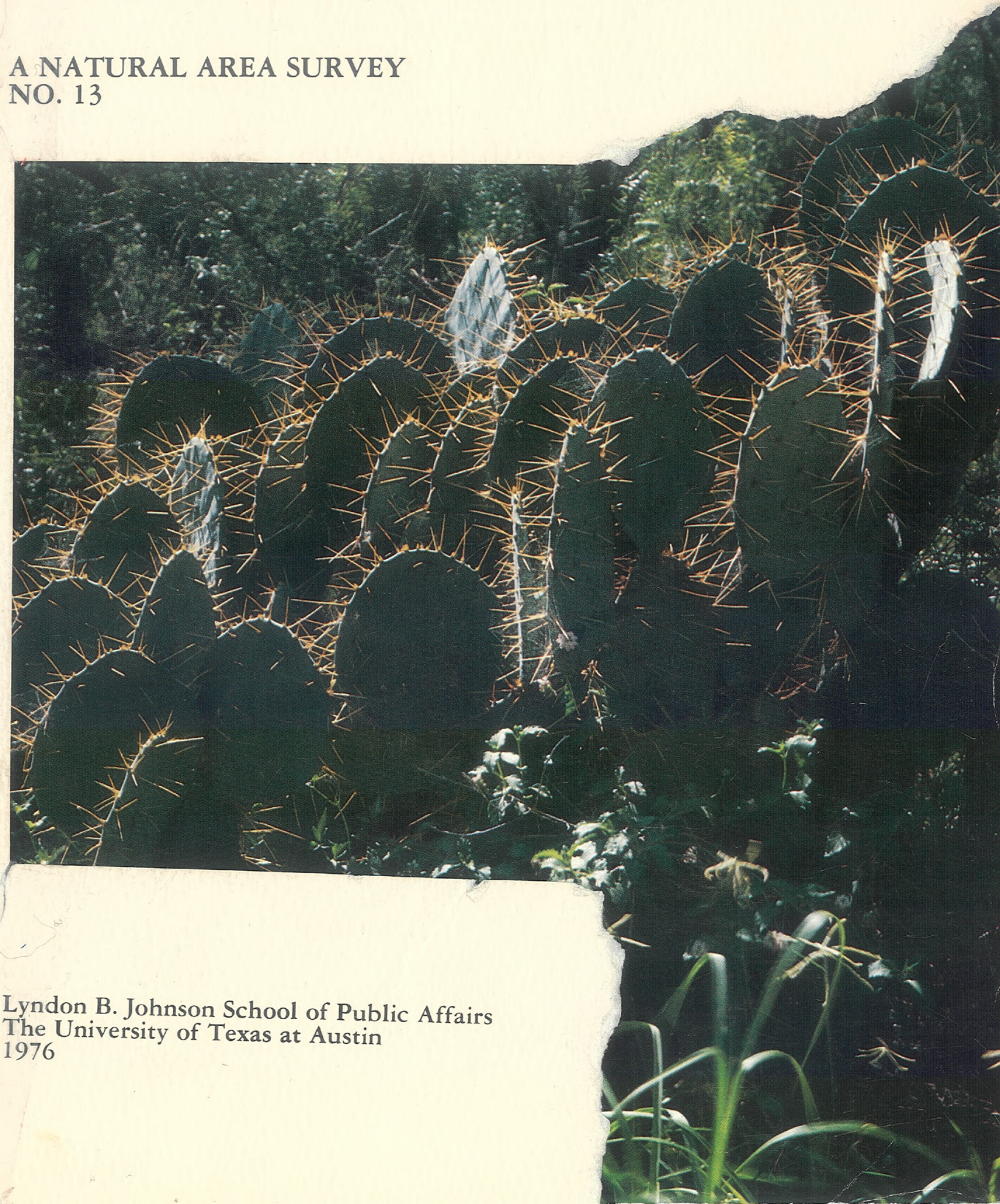
RIO GRANDE-
FALCON THORN WOODLAND

A NATURAL AREA SURVEY
NO. 13



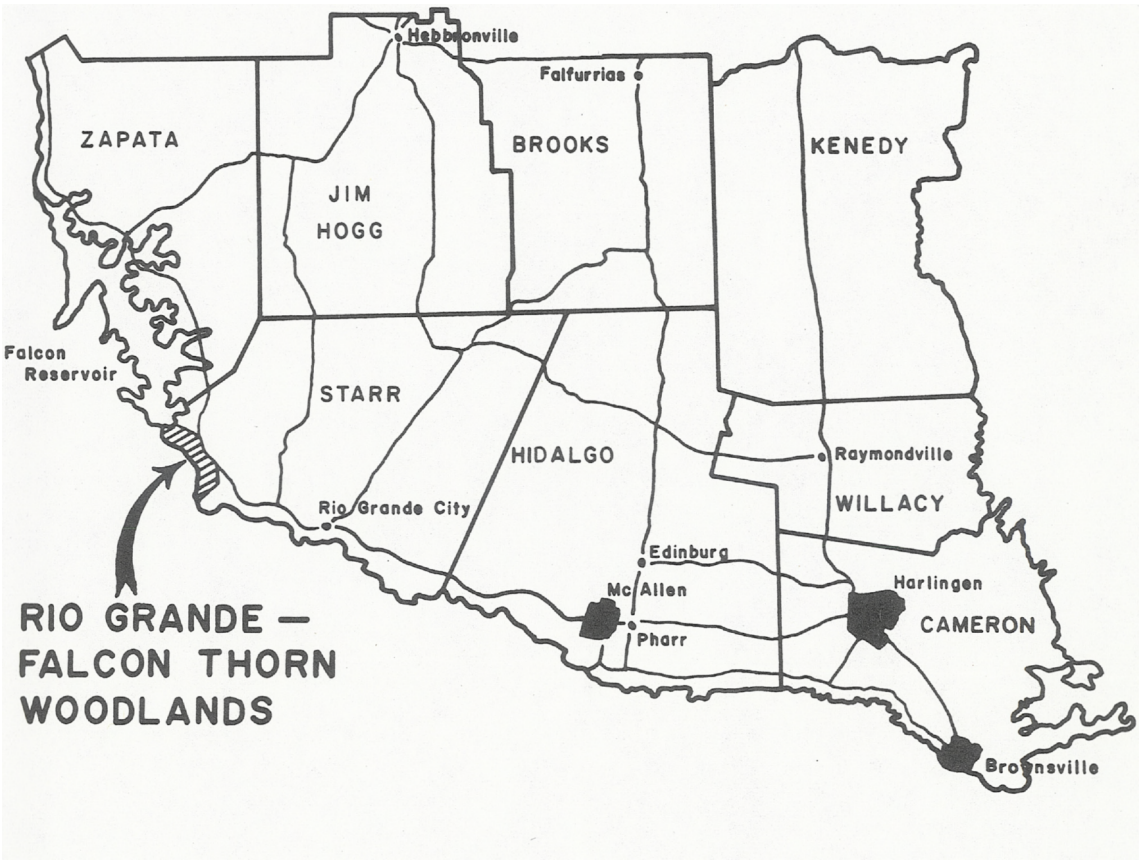
Lyndon B. Johnson School of Public Affairs
The University of Texas at Austin
1976

The full-color frontispiece is by photographer Reagan Bradshaw and represents but a small part of the work he recorded in the course of the Rio Grande-Falcon Thorn Woodland area survey. Transparencies of his photos of this and other survey areas have been filed with the Natural Areas Survey project, Lyndon B. Johnson School of Public Affairs, The University of Texas at Austin. Mr. Bradshaw is one of the finest nature photographers of the Southwest. His work on these natural areas is sure to increase public awareness of the need to save and protect.

RIO GRANDE-
FALCON THORN WOODLAND

A NATURAL AREA SURVEY
NO. 13

Lyndon B. Johnson School of Public Affairs
The University of Texas at Austin
1976


Hebbronville
Falfurrias
ZAPATA
BROOKS
KENEDY
JIM
HOGG
Falcon
Reservoir
STARR
HIDALGO
Raymondville
WILLACY
Rio Grande City
Edinburg
Mc Allen
Harlingen
CAMERON
Pharr
Brownsville
RIO GRANDE —
FALCON THORN
WOODLANDS

THE UNIVERSITY OF TEXAS AT AUSTIN
LYNDON B. JOHNSON SCHOOL OF PUBLIC AFFAIRS
AUSTIN, TEXAS 78712

Texas Parks and Wildlife Commission
Pearce Johnson, Chairman
4200 Smith School Road
Austin, Texas 78744

Dear Mr. Chairman:

The Lyndon B. Johnson School of Public Affairs of The University of Texas at Austin respectfully submits herewith its report, Rio Grande-Falcon Thorn Woodlands: A Natural Area Survey, pursuant to the joint request of the Texas Historical Commission, the General Land Office, and the Texas Parks and Wildlife Department, and in fulfillment of Inter-agency Contract (74-75) 1168.

The Rio Grande-Falcon Thorn Woodlands, like each of the other areas undertaken at your request, was scientifically and historically surveyed, mapped, and photographed, which involved the recruitment and direction of a field team of geologists, archeologists, botanists, zoologists, paleoentomologists, ornithologists, cartographers, photographers, landmen, and historians.

Texas is a diverse and beautiful land with a rich heritage and abundant natural and scientific wonders that should be preserved for the wise use and enjoyment of ourselves and of generations to come. As your commission pointed out in requesting this survey, the more significant natural areas are disappearing all too rapidly in Texas. It is our hope that the data gathered here will be instrumental in reversing that trend.

Sincerely,

Don Kennard

Don Kennard
Director
Natural Areas Survey

FOREWORD

The Natural Areas Survey project of the Lyndon B. Johnson School of Public Affairs at The University of Texas presents this study of Falcon Dam-Thorn Woodland, a unique Texas natural feature. This report is respectfully submitted to the Governor, the Texas Legislature, and the Texas Parks and Wildlife Commission in order that they be more fully informed about the resources of the state.

All studies in this series were prepared by multidisciplinary teams representing the natural and social sciences. Each study presents a comprehensive survey of the plants, animals, and geology of the area, as well as a review of its importance to man, both ancient and modern. The sites were chosen to fall within the definition of natural areas used in the Texas Outdoor Recreation Plan (Texas Parks and Wildlife Department 1975), "natural areas are areas or sites, which, because of their scenic beauty, rarity, recreation value, uniqueness, ecological importance, or cultural value should be protected for posterity."

There are perhaps a few hundred natural areas remaining in Texas, ranging from sections of mountainous land to half-acre sloughs. They can be found among our mountains, plains, shores, and woodlands. Together they could form a network of wildlife sanctuaries and study areas. It is our hope that citizens and state officials will commit themselves to the cause that these areas be preserved as remnants of the natural world and as sanctuaries for the rare and fragile living things which are succumbing to man's increase on this globe. If these areas are overtaken by development, these studies will provide a bare record of the beauty and scientific wonder which was lost.

With the release of this and the companion reports of this year, the list of project areas now stands at thirteen. Other reports in the series are:

Capote Falls
Matagorda Island
Mount Livermore and Sawtooth Mountain
(and supplement)
Victorio Canyon
Blue Elbow Swamp
Devils River
Canadian Breaks
Devil's Sinkhole Area—
Headwaters of the Nueces River
The Solitario
Fresno Canyon
Bofecillos Mountains
Colorado Canyon

ACKNOWLEDGEMENTS

Material for this and the other four reports in this series was assembled and edited by Don Kennard. Editorial contributions to the final manuscripts were made by Griffin Smith, Jr., Senior editor of *Texas Monthly* magazine, Truett Latimer, Executive Director, Texas Historical Commission, Dr. Marshall Johnston, Professor of Botany, The University of Texas at Austin, Curtis Tunnell, State Archeologist, and Edgar B. Kincaid, Jr.

Color frontispiece was by Reagan Bradshaw. Erlene and Linda Hill were responsible for typography and prepared the layout with the help of B. J. Hill. We are indebted to Senator Raul Longoria for his helpful introduction to local community leaders and landowners; to John C. Arvin for his photographs and observations of Rio Grande Valley birds; to Dr. Keith Arnold, Dr. Stephen Spurr, and Ross Shipman of the Division of Natural Resources and Environment; to the Lyndon B. Johnson School of Public Affairs, The University of Texas at Austin; and to Ronnie Fiesler, Barbara Walker, and John McCully of our staff for their assistance in handling the multitude of details and arrangements necessary to produce these reports.

We are especially grateful to Exxon Co. USA whose interest, encouragement, and generous grant of funds made possible the publication of these reports and significantly enhanced the field research effort of this and other projects undertaken by the Survey.

It is difficult to acknowledge, without omission, the time and effort unselfishly given by so many friends of Texas's natural heritage. With a fear that we may have inadvertently missed others, we wish to give special thanks to:

Bob Armstrong, Commissioner of the General Land Office

Ned Fritz and the Texas Natural Area Survey

Clayton Garrison, Paul Schlimper, Mark Gosdin, and numerous employees of the Texas Parks and Wildlife Department

Texas Historical Commission and its staff

Chairman Pearce Johnson and the members of the Texas Parks and Wildlife Commission

Anders Saustrup and the staff of the University of Texas Rare Plant Study Center

United States-Mexico Boundary and Water Commission

George Boyle and the Ringold Hotel, Rio Grande City, Texas

Raul Gonzales and family, Roma, Texas

Falcon State Park staff

Texas Chapter of the Audubon Society

CONTRIBUTORS

REAGAN BRADSHAW — B.A. Plan II, The University of Texas at Austin. Fields: landscape, wildlife, and industrial photography. Former chief photographer, Texas Parks and Wildlife Commission; published in *Audubon, National Geographic, Texas Parks and Wildlife, Texas Parade,* and *Texas Monthly* magazines and nationally recognized professionally as one of the outstanding nature photographers of the Southwest.

MARY BUTTERWICK — B.A., M.A. Botany, The University of Texas at Austin. Botanical Team Leader, director of the botanical fieldwork, and principal author of the botany sections of all reports.

DWIGHT E. DEAL — B.S. Rennselaer Polytechnic Institute; M.S. University of Wyoming; Ph.D. Geology, University of North Dakota. Former Associate Professor of Geology, Sul Ross State University; geologist for the North Dakota Geological Survey in summers of 1969, 1970, and 1971; Research Scientist Associate, Bureau of Economic Geology, The University of Texas at Austin, 1972-1973; Director, National Speleological Society; Geologist and Director, Chihuahuan Desert Research Institute, Alpine, Texas. Coordinator of the Scientific Team and author of geological section of each report.

DON KENNARD — B.B.A., The University of Texas at Austin. Fields: Ecology and Government. Former consultant to the Division of Natural Resources and Environment and former consultant to the Director of Research, Lyndon B. Johnson School of Public Affairs. Natural Areas Survey Project Director.

NANCY O'MALLEY — B.A. Anthropology, The University of Texas at Austin. Candidate for M.A. Anthropology, University of Kansas at Lawrence. Former Survey Archeologist with the Texas Historical Commission and the Texas Archeological Survey. Author of archeological section of the Rio Grande-Falcon Thorn Woodland report.

BRUCE SAUNDERS — B.A. Government, Denison University; M.A. History, Southwest Texas State University; Ph.D. History, The University of Texas at Austin. Former history instructor at Austin Community College, Southwest Texas State University, and The University of Texas at Austin. Author of history sections of all reports.

JAMES F. SCUDDAY — B.S. Zoology, Sul Ross State University; M.N.S., University of Idaho; Ph.D. Wildlife Science, Texas A&M University. Associate Professor of Biology, Sul Ross State University. Fields: Ecology and Systematics of Vertebrate Animals. Conducted zoological investigations, prepared collections, and authored the zoological section of the Solitario, Fresno Fanyon, Colorado Canyon, and Rio Grande-Falcon Thorn Woodland reports.

LA FERNE SCUDDAY — B.S. Botany, Sul Ross State University; candidate for M.A., Sul Ross State University. Zoological Assistant in preparation of collections and in writing the zoological section of the Rio Grande-Falcon Thorn Woodland report.

GRIFFIN SMITH, JR. — B.A. History, Rice University; M.A. Government, Columbia University; J.D., The University of Texas School of Law. Fields: Government, Law, Research, and Journalism. Former Committee Counsel to the Texas Senate Interim Drug Committee; Senior Editor, *Texas Monthly* magazine; Texas Institute of Letters Stanley Walker award winner. Project Editor and author of the "Impressions" section of each report.

STUART STRONG – B.A. Political Science, University of Alabama; M.A. Botany, The University of Texas at Austin. Former co-director of the Rare Plant Study Center, The University of Texas at Austin. Botanical Assistant in fieldwork, in preparation of collections, and in writing the botany section of the Solitario, Fresno Canyon, Colorado Canyon, and Rio Grande-Falcon Thorn Woodland reports.

SUZANNE WINKLER – B.J., The University of Texas at Austin. Worked with Edgar B. Kincaid, Jr. for five years editing H. C. Oberholser's *Bird Life of Texas*; has edited two other ornithological books, *Parent Birds and Their Young* by Alexander F. Skutch and the National Audubon Society's *Wading Birds*; copy editor of *Texas Monthly* magazine. Author of the bird section in the Rio Grande-Falcon Thorn Woodland report.

IMPRESSIONS OF RIO GRANDE – FALCON THORN WOODLANDS

Griffin Smith, jr.

Disgorged from the turbines of Falcon Dam, the Rio Grande begins its final, sluggish journey to the sea. The great impoundment completed in 1953 is the last barrier to the once-wild waters that have churned their way down from the Big Bend canyons' rapids and cliffs. Beyond the breaks of Starr County the brown river eases, tamed and spiritless, toward the estranging coastal sands.

For a short distance below the dam, however, an isolated half-forgotten remnant of tropical thorn woodland luxuriates along the riverbank. This brief thicket is one of the few remaining pockets of native vegetation in South Texas. Less than half a dozen other sites downstream still preserve traces of a similar environment, and none of these can equal the pristine character of the Falcon Woodland. Almost within earshot of the spillway itself, tropical Texas survives.

The woodland and its adjacent alluvial terraces and chapparal uplands harbor South Texas' most distinctive collection of plant and animal life. Species familiar to northern regions and the western deserts exist side-by-side with others native to Mexico and Central America, many of which reach their northernmost distribution here.

The Mexican Burrowing Toad and the Mexican White-lipped Frog appear in the United States only in Starr and neighboring Hidalgo counties. The poisonous Giant Toad, which secretes venom through its skin, ranges from the South American tropics to this section of southern Texas. The bird population is so extraordinary that birders from all across the United States make periodic pilgrimages to observe the Falcon avifauna: twenty species of tropical birds come to Falcon and no farther–attracted, in part, by its tall timber, dense undergrowth, and the few miles of clear water below the dam. Among the notable birds are the Brown Jay, a native of lowland Mexico and Central America which has recently been found nesting at Falcon; the Green Jay; the Chachalaca; the Oliveaceous Cormorant; the Gray Hawk; the Black-headed Oriole; Lichtenstein's Oriole; the Olive Sparrow; the Groove-billed Ani; the Ferruginous Pygmy Owl; and the Ringed Kingfisher.

The premier botanical treasure of the seven-mile stretch between the dam and the sleepy little town of Salineño is a stand of thirteen Montezuma Bald Cypresses, the largest of which has a circumference of more than fourteen feet. The drooping, coniferous branches of this noble tree are a not-uncommon sight southward into Mexico, but this is the only known grove in the United States. Three other rare plants have been identified in the vicinity of Falcon: Gregg wild buckwheat, previously seen only at one site in Hidalgo County; Slashleaf heartseed; and the vivid, orange-petaled *Amoreunia wrightii.* Texas ebony and anacahuite, less rare, also reach their northern limits here; and natural gardens of peyote, the hallucinogenic holy cactus of the Indians, thrive in Starr County's sandy soil as nowhere else north of the Rio Grande.

Deceptively somnolent by day, Falcon Woodland is transformed after dark. Its night sounds throb with life: the jetlike whine of thousands of cicadas; the irregular chorusing of frogs; the insistent buzz of circling mosquitoes, and of course, the birds. In summer the Lesser Nighthawk darts, batlike, scattering hollow feline purrs; and the Pauraque adds a multisyllabic whistle. Carry a powerful artificial light into the woods at night and meet the enveloping tropics' enigmatic stare: the Pauraque's eyes, caught in the beam, shine pink; and along the ground, ephemeral phosphorescent mushrooms glow.

Probably no other place in Texas combines such hospitality to plants and animals with such extreme inhospitality to man. William McClintock, who passed through the region in the nineteenth century, expressed the definitive truth: "There is," he said, "nothing of the vegetable world on the Rio Grande, but what is armed with weapons of defense and offense." Even allowing for a certain mellowness along the floodplain itself, this is cruel country–as Cabeza daVaca found, as Santa Ana found, as anyone finds today traversing it on foot. Empty it may seem, but it is not to be trifled with.

Especially not in summer, when the effective temperature (a combination of humidity, heat, and air movement) is the highest in the United States: worse than Death Valley, comparable to the Red Sea. The wife of an Army Officer stationed at Ringgold

Barracks (at Rio Grande City) in the 1850s spoke for generations when she declared: "There never was a country more unfitted by nature to be the home of civilized man than this region of the lower Rio Grande of Texas. It seems to hate civilization. . . ." Frosts are rare; droughts the norm; and the humidity is overwhelming.

The region has always been a hard and uncomfortable place. The aboriginal Coahuiltecans were nomadic wanderers who wore little clothing, fashioned primitive tools from pink and gold rhyolite, and ate anything their systems could digest—including, if the archaeological evidence is to be believed, substantial quantities of snails. Though related to one another, the Coahuiltecans subsisted in small groups of warring bands, their cultures differing from drainage to drainage across South Texas. As if living out a curse as old as Genesis, they spoke mutually incomprehensible dialects.

European influence came relatively early to this region, though it was not until 1840 that the Coahuiltecans themselves had entirely vanished, by disease and assimilation into the Mexican population. The first recorded Spanish explorer, Alonzo de Leon, crossed the river in 1686 at Salineño ford, which he called El Cantaro. Official Spanish interest focused elsewhere for several decades; but in the half-century after 1739, successful colonial outposts of Spanish civilization were established along the south side of the River (among them Camargo, Reynosa, and Mier), while companion settlements on the north side, like Dolores, failed. By 1781, every parcel of riverfront land had been claimed.

Development of the Falcon region, like much of the rest of the Nueces Strip, was delayed by violence and disorder. Indian raids (the last, by Comanches, Kiowas, and Apaches, took place in 1837) were followed by a lawless period of banditry. Mexican invasions of the Republic of Texas were countered by freebooters like Colonel W. S. Fisher, whose Texian force, captured under a flag of truce in 1842 at Mier, was decimated and imprisoned. The establishment of Ringgold Barracks in 1848 was a signal that order would prevail—which, with occasional lapses, it eventually did. Soon the Roma-Matamoros river run was an important commercial passageway for hides, lead, and wool. In the ensuing century, agriculture and ranching established themselves—less securely in Starr County than elsewhere in the Valley, but sufficiently well to alter irrevocably the character of the land on the perimeter of Falcon Woodland.

Grasslands have given way to chapparal: nothing remains of the sight that greeted visitors in the 1850s, when grass extended from the river at Rio Grande City to a point sixteen miles inland. With the grass has gone the water table that sustained the intermittent streams used by the Coahuiltecans. Consequent erosion in the flood-prone arroyos has carried away much, though not yet all, of their pitiful remains.

In recent years the chapparal has in turn given way to quarrying, grazing, and cultivation. Deprived of protective vegetation, the animal life of the region has undergone profound change. Since the early 1950s the number and variety of mammals has fallen sharply; jaguars, ocelots, and jagarundis have disappeared altogether. Such diverse birds as the Oliveaceous Cormorant, the Black Hawk, the Red-billed Pigeon, the Tropical Paurula, the Black-headed Oriole, and the Elf Owl have been adversely affected by the clearing of land and by the increased human presence near Falcon Dam.

Man is closing in on the Falcon Woodland. But in the heavy humid heat of a summer afternoon, as Blue Spiny Lizards scramble over the grainy rocks and the pale green branches of Montezuma Cypress arc lazily in a gust of wind, he seems as distant as the polar ice.

HISTORICAL SURVEY OF THE RIO GRANDE AREA IN STARR COUNTY

Bruce D. Saunders

In the far southern region of Texas, across a dry and desolate plain, the Rio Grande slowly winds its way to the Gulf of Mexico. Along its last 320 km, the river provides a way of life to the people of the towns that cling to its banks on both the American and Mexican sides. It has always brought water to these parched lands, served as a vital means of transportation, and often separated the two republics—the United States and Mexico. While the presence of the Rio Grande has influenced the people who have settled along its banks and almost forced them into certain occupations, man only recently has had success in controlling the river that has played such a central role in the development of life in south Texas. Its meanders have resulted in territory being traded from nation to nation and also causing local problems and international disputes. Numerous spring floods used to add tons of fertile topsoil to the floodplains of the river while also inundating towns and cities along its path and claiming a large number of lives. Today, as the result of carefully planned and executed international treaties, a series of major dams have been completed that have tamed the Rio Grande. They have reduced its former destructiveness, but also have eliminated its ability to deposit topsoil along its floodplains. Both Falcon Dam, completed in 1954 in northern Starr County, and Amistead Dam, located north of Del Rio, provide large recreation areas, inexpensive electrical power, and flood control. Although the lakes located behind both dams provide water for irrigation projects, they also lose thousands of acre-feet of water per year through evaporation.[1]

The area between the small town of Roma and Falcon Dam, a distance of only 25 km on Highway 83 or about 50 km on the Rio Grande, is much different than either the central portion of the valley or the eastern section. While groves of citrus trees and acres of irrigated fields of vegetables dominate life in these latter sections, the western area of Starr County remains quiet, perhaps even reflective. The discovery of oil and gas in this area has not quickened the pace of life, and most of the land is still devoted to ranching. The small towns of Fronton, Salineño, and Chapeno are nestled along the east bank of the river, isolated from the roar of the traffic as it thunders down US 83 toward Roma and Rio Grande City. Behind the siesta-like atmosphere of these towns, there is an interesting history that spans two centuries.

The Rio Grande Valley of Texas has not always been as quiet as it has been in recent decades. Although living in this dry and hot area was difficult, it has been the home of a number of differing civilizations that staged many power struggles to ward off intruders. Prehistoric men battled here and later tribes of Indians fought for the area. The invading Spanish explorers hoped to convert the Indians to Catholicism and eventually control the land. The Texans and Mexicans struggled with each other over this territory for decades. In the 19th and 20th centuries, some of the worst border raids in all of American history took place along the Rio Grande. But why would so many men from such varied cultures continue to fight over a hot, waterless, virtually barren land? Many people have wondered what the Rio Grande Valley had to offer. Mrs. Egbert Viele, who joined her husband, a lieutenant in the United States Army stationed at the Ringgold Barracks in the 1850s, found it difficult to understand why anyone would want to live in south Texas. "There never was a country more unfitted by nature to be the home of civilized man than this region of the lower Rio Grande of Texas. It seems to hate civilization . . . it seems only to be intended as a home for desperate men, escaped refugees from the law. . . ." She concluded that only the strongest men could survive and observed, "Americans on the Rio Grande may be considered as the most daring, adventurous set of men in the world."[2] Mrs. Viele was partially correct. It did take a unique type of pioneer to master the climate and problems of south Texas. Her belief that the area was "unfitted by nature to be the home of civilized man" was accurate in the mid-19th century, but recent progress has made the valley a more pleasant and prosperous place to live.

The earliest residents of the area congregated along the Rio Grande in order to have sufficient water and to cultivate the rich alluvial soil that the river had deposited. One survey team, under the sponsorship of

the Smithsonian Institution, located two historic sites and one prehistoric site in the area of Falcon Dam before construction began.[3] Another more extensive survey of the same area uncovered 55 sites. This team classified 13 as having unusually great importance, 28 of ordinary quality, and the remaining 14 of only slight interest.[4] However, only a limited amount of field work was completed, due, in part, to the impending construction of the dam and, also, the lack of adequate funds for the project. The few sites that were excavated revealed that the people of the Rio Grande region belonged to a static culture, spending most of their time attempting to survive in a hostile environment.

These early peoples slowly died out, and the large Coahuiltecan tribe of south Texas replaced them. The Coahuiltecans, a large, loose confederation of many tribes and bands, lived in an area south of the Balcones escarpment, along the Rio Grande toward the lower Gulf coast.[5] Linguistically, these early south Texas tribes were related to the Hokan tribe of California, but were somehow split apart in the prehistoric period. The Coahuiltecans, like all other peoples, had a diffficult time surviving in south Texas. They subsisted on small animals (rabbits, reptiles, birds, and bugs) along with the larger animals that they occasionally killed, including deer, antelope, javelina, and buffalo. They also ate pecans, mesquite beans, maguey, sotol, lechuguilla, and cactus as well as the fish they caught in the Rio Grande, rattlesnakes, worms, lizards, spiders, ant eggs, and anything else they thought had some food value.[6] They attacked anyone who crossed their territory and openly raided their neighbors in search of food. They wore simple clothing, lived in small, often movable, shelters and hunted with bows and arrows, along with curved wooden sticks that were used to stun small gamelike rabbits.[7] Cabeza de Vaca, the amazing explorer, wandered among the Karankawan and Coahuiltecan tribes for eight years, 1528-1536, and later recorded many of his experiences. His narrative has provided current anthropologists with much of their present knowledge about the Indians of south Texas.[8] Newcomb concludes that the "Coahuiltecans made an admirable adjustment to the restrictions and privations of their land with but crude and primitive tools and exploitive techniques. Their success . . . was compounded of a willingness to utilize virtually everything in their environment that a human could digest . . . [and] an intimite knowledge of their land. . . ."[9]

New diseases, conflicts with other tribes, and the appearance of the Spanish explorers all helped to decimate the Coahuiltecans, who had completely disappeared by 1800.[10] Alonzo Alverez de Pineda explored the lower Rio Grande (Rio de las Palmas) for 40 days in 1519, but, because of Indian attacks, there was a long period of over a century and a half when Spain did not send any explorers to the North. In 1686, and again the following year, Alonzo de Leon crossed the Rio Grande while unsuccessfully searching for a French settlement. LaSalle's fortress. De Leon did discover an excellent ford on the Rio Grande, El Cantaro, about 15 km west of the present site of Roma.[11] Other Spanish explorers concentrated their efforts farther to the North and founded missions at Eagle Pass and San Antonio. Attempts to organize and control the area along the lower Rio Grande began in 1739, were increased in 1743, and greatly intensified in 1746 when the new province of Nuevo Santander was established. Jose de Escandon was selected as the first governor.[12] He was an able administrator, a good organizer, and a devout Catholic. As the Indians did not create any difficulties at first, Escandon moved ahead with his elaborate plans to construct missions and towns along the Rio Grande, especially junctions of the small streams and the river. The major attractions of this frontier region included the lure of inexpensive but fertile land, the great economic potential of the livestock business, the opportunity to develop trade along the Rio Grande and with the interior of Mexico, and the adventure and excitement of an unsettled area.[13]

Escandon made his first visit to the Rio Grande in February 1747 and filed a lengthy report on the conditions he found. He urged the King to approve his colonization plans immediately.[14] First he established colonies in the southern part of Neuvo Santander, then moved north toward the Rio Grande to found Camargo in March 1849, near the confluence of the San Juan and Rio Grande, and Reynosa on the Rio Grande later the same month. Other early settlements included Revilla (known since 1828 as Guerro), located near the junction of the Salado and the Rio Grande. Established with only 43 families in 1753, it grew rapidly and experienced a 70% increase in population during its first 10 years.[15] Mier, located halfway between Camargo and Revilla on the Alamo River and near the famous Cantaro ford, was established in 1752. Mier's location was important because it controlled the strategic salt route that led from two large saline lakes north of the Rio Grande to the southwest toward the cities of Cerralvo and Monterrey. These salines provided salt to a large portion of northern Mexico and helped to create one of the most heavily used trade routes in the Southwest.[16] Farther to the north, Laredo was founded in 1754, and the first colony on the north side of the Rio Grande, Dolores. The latter, established in the summer of 1750, collapsed several years later.[17]

These outposts of Spanish civilization had to contend with the Indians, the weather, and the Rio Grande if they wanted to survive. An inspection trip in 1757 revealed that the small settlements were slowly winning the battle over the hostile elements. In Mier there were 39 families living in mud or stone huts, while outside of the town five large ranches contained a total of 4,000 head of horses and cattle and an amazing total of 40,000 sheep. Revilla was even more prosperous, claiming 357 settlers and 29 ranches with a combined total of 50,000 head of cattle, horses, mules, and sheep. The residents attempted to construct an irrigation system to supplement the limited rainfall, but it failed because the depth of the riverbed was greater than the fields they planned to irrigate. Camargo had serious problems with a flood, a drought, and Indian raids. Dolores did not expand, and in 1757 consisted of only one ranch with a total of 23 familes who served as laborers.[18]

Ten years later, the Royal Commission inspected the Rio Grande settlements for the purpose of issuing tracts of land to the settlers. The size and location of these small grants, or *porciones,* were based on the amount of time a resident had spent in a particular town. They were narrow plots that ran in a perpendicular direction from a body of water, usually a river. At Revilla, a total of 68 *porciones,* extending along both the Rio Grande and the Salado, were granted to residents. In some cases, *porciones* were assigned on both banks of the Rio Grande. In return for their land, the settlers agreed to use it for ranches, to live under military protection, and to band together to defend their town and lands from Indian attacks. The Mier, Camargo, Reynosa, and Laredo settlements were all divided into *porciones* in a similar manner.[19] After the ceding of these original *porciones* in 1767, larger grants were awarded for ranching and grazing in the 1768-1810 period. The vacant lands on both sides of the Rio Grande were assigned to owners during the 1770-1810 period.[20] Many disturbing problems appeared, including the fact that all of the land that fronted on a river had been claimed in 1781. The Indians continued to attack outlying ranches and settlements, but the missionaries hoped to convert many of the Indians during the final years of the 18th century and thus to eliminate many of the depredations. The population of the province of Nuevo Santander reached 15,000 in 1800, and the smaller settlements on the Rio Grande seemed more secure.[21] An inspection trip of 1795, however, revealed that there were just over 2,000 Indian warriors on the Nuevo Santander frontier, a fact that made the security of the province doubtful. Felix Calleja who led the inspection team, devoted most of his lengthy report to assessments of Indian strength and proposed methods for defeating them with a limited number of soldiers. He found the residents relatively prosperous but in need of better transportation, a means to export livestock, and more frontier protection.[22] His report was the last major detailed report on the province before the seeds of revolution began to grow. In 1821, the revolt against Spain was over, and Mexico was a free and independent republic.

Following the successful conclusion of the revolution, new groups of settlers began to move into the large area between the Rio Grande and the Nueces River. Johann von Raknitz led over 200 European colonists to a new colony on the Nueces, but it failed to expand and had to disband. Benjamin Lundy, the famous American abolitionist, travelled through the Rio Grande Valley in 1833-1834 seeking a grant of land that he planned to use as a refuge for freed slaves but was unable to locate an acceptable site and so abandoned his plans for a center in south Texas.[23] Dr. John C. Beals and the Rio Grande and Texas Land Company sponsored 59 European immigrants who journeyed across the Gulf of Mexico to Aransas Bay in 1834. Beals had obtained a grant of land between the Rio Grande and the Nueces, but he finally located his colony on the south side of the Rio Grande. Indian raids, the harsh climate, and other hardships forced the small colony to dissolve in 1836.[24] Samuel Bangs obtained a large tract of land north of the Rio Grande that contained 30 leagues and 30 labors of land, but his plans for settlement were never realized.[25] Although more new residents were moving into Texas and the separation from Mexico was imminent, very few people ventured south of the Nueces to establish new homes or businesses. The Indian menace was still a major deterrent for many of them. Even after Texas gained its independence from Mexico and proclaimed itself a republic, Indian raids along the Rio Grande from Laredo to Brownsville continued. The Commanche, Kiowa, Lipan, and Mescalero Apache tribes all participated in the violence that occurred in 1836-1837. Neither the Republic of Texas nor the Mexican government was able to provide adequate protection for the citizens who lived along the Rio Grande.[26]

The nearly empty area between the Nueces and the Rio Grande acted like a political vacuum that attracted some unusual men who planned to link the south Texas region with portions of northern Mexico to form an independent republic. This plan evolved out of a long-standing battle between two Mexican political factions, the Centralists and the Federalists. The concept was the work of a Mexican newspaper editor, O. de A. Santangelo, who had been deported from the country. His separatist plan involved the

union of the northern provinces of Zachetecas, Durango, Coahuila, and Nuevo Leon, together with areas of the present states of New Mexico, California, and Texas into the Republic of the Rio Grande.[27] The new nation was officially established during a convention at Laredo in January, 1840, and began its operations with Juan Cardenas as President and General Antonio Canales as the Commander-in-Chief of its armed forces. From the capital at Guerro, the Federalists (the Republic of the Rio Grande) were able to engage and defeat the Centralist forces from Mexico City. Eager for monetary support and also interested in obtaining military supplies, Juan P. Amaya travelled to Texas to gain support from the people, and especially from the president of the Republic of Texas, Mirabeau B. Lamar. Many Texans were intrigued with the new Republic of the Rio Grande, including Colonel George S. Fisher, Colonel Reuben Ross, and Captain S. W. Jordan who actually joined the Federalist forces. They went to northern Mexico to fight but escaped to Texas when their army lost a major battle at Saltillo on November 6, 1840. Although the Republic of Texas remained officially neutral toward the new republic, many private citizens publicly supported the new regime in the hope that it would serve as a buffer state which would perhaps eventually fall under the domination of Texans and increase the land area and prestige of Texas.[28]

Without a standing army, the young Republic of Texas had other problems in addition to the Indian menace and separatist movements along its borders. In March, 1842, General Santa Anna sent an army across the Rio Grande that captured San Antonio, Goliad, and Refugio, but it retreated across the border after several days without inflicting any serious damage. While many Texans demanded war with Mexico as a reply to the invasion, President Sam Houston vetoed a bill that called for war and provided funds to pay for the army. As tempers cooled, General Adrian Wool staged another invasion of Texas in September, 1842. He marched his men to San Antonio, captured the undefended city and held it for nine days before returning to Mexico with a number of prisoners, including a district judge. After the Texas militia was called out, General Alexander Somervell led a force of 750 men to Laredo and captured the town on December 8, 1842. At that point, most of the Texans decided to return to their homes, but over 300, eager to avenge the Mexican raids, refused to obey Somervell's order and organized under the command of Colonel W. S. Fisher to attack other towns in Mexico.[29]

The Texan force trooped down the east side of the Rio Grande to a point opposite the town of Guerro where they prepared to launch an assault. Following a minor battle at Guerro, Fisher's men recrossed the Rio Grande and moved to the southeast where they camped across the river from Mier. An advance party met with the mayor of Mier and demanded food and arms for 1,200 men. When there was no guarantee that the supplies would be delivered, the Texans took an alcalde with them as a hostage. After waiting patiently for two days for the requested supplies and tribute, Fisher and his men were shocked to learn that both General Ampudia and General Canales were near Mier with a combined force of over 700 men and two pieces of artillery. The Texans unanimously agreed to advance and take the city. Leaving the east bank at two o'clock in the afternoon, they arrived outside of Mier and faced an army that has been estimated at about 2,300 trained men. The invaders, numbering only about 265 effective soldiers, fought very well and were winning the battle until the Mexican leaders displayed a flag of truce. During the negotiations that followed, the Mexican generals convinced many Texans that they were completely surrounded and in danger of annihilation. They presented an honorable surrender as the only viable alternative. At first Colonel Fisher's men were divided on the proposal but finally agreed that an honorable surrender was the best alternative in the situation. Little did they realize that their imprisonment would last for years and result in death for many of their comrades. After the surrender, the Texans were led down the Mexican side of the Rio Grande and paraded through the streets of Camargo, Reynosa, and Matamoros before being marched to Salado where Santa Anna ordered every tenth man executed. The infamous drawing of the black beans resulted in 13 Texans losing their lives before a firing squad. The remaining men were taken to the Perote Prison where those who were unable to escape were held until 1844.[30]

Despite the problems that the Republic of the Rio Grande and the ill-fated Mier Expedition generated, the lower Rio Grande Valley was slowly attracting a few settlers. Jesus Trevino crossed the Rio Grande with his family in 1830 and established the town of San Ygnacio across from the Arroyo Salado or about six miles north of Zapata. He constructed a combination fortress-ranch house for protection from both the Indians and the frontier bandits. An impressive sundial was added to the roof of the structure in 1851.[31] Henry Redmond, a pioneering Texan, settled in the same area nine years after Trevino. He filed for and established a claim on some land south of San Ygnacio that was initially called *habitacion de Redmond,* but was later changed to Bellville in honor of Governor Bell. After several more years, the name

was once again changed to Carrizo in reference to the Indians who lived in that region. When the Rio Grande flooded in 1898, the town had to be relocated, and it was renamed for the last time. Since many people confused Carrizo with the town of Carrizo Springs that is located northeast of Laredo, the town on the Rio Grande was called Zapata in honor of Colonel Don Antonio Zapata.[32] Both of these towns marked the beginning of a new interest in the Starr and Zapata county area of Texas. Yet many people were convinced the land was worthless. A young man who crossed the Trans-Nueces region in 1846 wrote, "the man who possessed leagues of this disgusting 'territory' (the land between the Nueces and the Rio Grande) would be like he who hath self-righteousness—the more he had, the worse would be his condition."[33]

One reason why many pioneers were hesitant to move into the south Texas area stemmed from a dispute over the ownership of the region. Both Texas and Mexico claimed it, and the Treaty of Velasco that terminated the Texas Revolution in 1836 was unclear on the subject. Texas and later the United States claimed the Rio Grande as the southern Texas/U.S. boundary, while Mexico held that the Nueces was its northern borderline. The 125,000 square miles in between the two rivers was a "no-man's land" for over 10 years. As one historian expressed it, "The problem of the boundary resulted in a contest between a weak power relying on documentary evidence with a powerful neighbor engaged in blocking out its natural limits from ocean to ocean. Such a contest could have but one ending, but it is no more than just to admit that, from a documentary point of view, the logic of the Mexican position was irrefutable."[34] But President James K. Polk and his advisors cared little for documentary evidence and sent General Zachary Taylor and his men south across the Nueces, thus precipitating the Mexican War. When the guns were finally silenced and the dead had been carried from the battlefields, the Treaty of Guadalupe-Hidalgo supported the American claim to the Rio Grande as the border. It also stipulated that Mexico had to surrender almost a half million square miles of territory that included the present states of California, Nevada, Arizona, New Mexico, and parts of several others.[35]

With the boundary problem resolved, the Mexican citizens living north and east of the Rio Grande were confronted with a momentous decision. They had to decide if they wanted to return to the Mexican side of the river or stay on the American side. There are no available figures to indicate the numbers of people that decided to return or stay in the United States.

The American and Texan presence grew stronger along the border with each passing year. Ringgold Barracks was constructed in 1848 just outside Rio Grande City. American soldiers stationed there gave a firm indication that the United States was not going to tolerate any problems along the border. Farther up the river, a temporary Army facility was erected near Redmond's Ranch. It was a massive two-story building which the Army used as a combination dormitory and warehouse for supplies. In July, 1853, there were 69 men and 59 horses there protecting the border and guarding settlers from Indian attacks. It was strategically located halfway between Ringgold Barracks and Ft. McIntosh, about 70 miles away in Laredo.[36] Four years later, Major William H. Emory of the United States Boundary Survey reported that there was a large trading establishment at Bellville along with a large warehouse that was designed like a "feudal castle" to protect its inhabitants from the Indians and bandits.[37]

With the American flag flying from the forts along the Rio Grande, the area began to show some signs of economic development. Steamboating on the shallow and meandering Rio Grande started in 1829 when Henry Austin sailed the *Ariel* from Matamoros to Camargo. During the Mexican War, Major John Saunders purchased four light steamboats for the U.S. Army: the *Corvette, Whitesville, Major Brown,* and *Colonel Cross.*[38] In October, 1846, Bryant P. Tilden, along with a crew of 47 men under the command of Captain Mark Sterling, took the *Major Brown* from the lower valley up the river to Laredo. Tilden carefully described the route and noted that the east bank of the Rio Grande was lined with "willow and small cypress."[39] He estimated that the population of Mier, "a good market for American goods," was about 8,000 people.[40] When the boat arrived at Laredo on October 24, 1846, it proved that the river was navigible but only with a flat-bottomed, shallow draft vessel, as the *Major Brown* did not draw over two feet of water.[41]

Despite the shallowness of the upper Rio Grande, commerce continued to increase in the Roma-Matamoros section of the river. The trip from Roma to Brownsville or Matamoros took three days for a steamboat. It was a well-travelled route as Roma shipped 20,000 finished hides, 3,000,000 pounds of lead, and 500,000 pounds of wool in 1860.[42] Roma served as a shipping point for the lead mines that were located near Monterrey and for the developing cattle business in both northern Mexico and southern Texas. The overhead for a steamship company was half what it was on any other southern river in the United States, deckhands and firemen demanding only $15 per month. Other needed supplies were also inexpensive, fresh beef selling for three cents a pound

and mesquite wood for the ship's boilers costing only a dollar a cord.[43] In addition to the steamboats that operated on the river, at various crossings there were a number of ferries that increased the volume of international trade.[44] Although the Indians and bandits remained as a threat, some early pioneers entered the cattle business. One reporter calculated that the cost of raising one steer was only $3.00 while the market price in 1860 was almost seven times that amount.[45] The mild climate, long growing season, and rich alluvial soils allowed farmers to raise cotton, corn, sugar cane, rice, oranges, figs, and pomegranates.[46] The California Gold Rush of 1848 and 1849 also brought some prosperity to the valley, as many prospectors travelled up the Rio Grande toward California, some remaining in towns like Roma where it was estimated that 95% of the trading involving Mexico was done illegally.[47]

During the pre-Civil War years, the lower valley was the target of many bandits who took advantage of the weakness of the American garrisons along the river. Juan N. Cortina, born in Camargo in 1824 but a resident of the United States after 1840, was a known gambler and thief. When the city marshal of Brownsville came to arrest him, Cortina seriously wounded the lawman, then organized a group of men and rode into Brownsville where he murdered five people and terrorized the town for days. The United States Army under the command of Major S. P. Heintzelman finally drove Cortina and his men to Mexico, but only after they had roamed at will in south Texas for three months.[48] Cortina and his followers ranged to the far end of the valley in search of anything they could steal. Noah Cox of Roma claimed he was unable to ship goods on the Rio Grande to New Orleans because Cortina would probably capture or destroy them. He requested a total of $6,500 from the United States government in compensation.[49] Despite an increase in terrorism along the border, the commanding officer of the Texas area, Brevet Major General D. E. Twiggs, felt that the area was safe from attack. "There is not, nor ever has been, any danger of Mexicans crossing on our side of the river to plunder or disturb the inhabitants, and all the outcry on that river for troops is solely to have an expenditure of the public money," according to Twiggs.[50] But residents of Starr County had evidence that contradicted General Twiggs. Samuel J. Stewart, the Chief Justice of Starr County, received about 600 head of cattle that had been stolen from Texans and transported to Mexico.[51] Some south Texas residents feared not only Cortina and the Indians but also the Texas Rangers. F. M. Campbell, a farmer, accused the Rangers of destroying his fences and stock pens for firewood, burning one of his horses, eating his hogs and goats, consuming 50 barrels of sweet potatoes, and then refusing to pay him for the damages. He also alleged that the Rangers occupied his property without his consent.[52] Claims for stolen cattle and other livestock for the two-year period, 1872-1873, totaled $48,496,235.25 in south Texas alone.[53] Cortina reappeared in 1870, when he became the Governor of Tamaulipas, and appointed a number of desperate men to assist him. Almost immediately, lawlessness increased on both sides of the border. The Rio Grande City jail was raided in August, 1877, to free a number of prisoners.[54] Americans staged raids that went well beyond the border area of Mexico. Colonel Ranald Mackenzie, with a sizable force of men, crossed into Mexico in May, 1873, and raided a Kickapoo village 60 miles from the Rio Grande.[55]

A United States House of Representatives Committee, composed of Thomas P. Robb, F. J. Mead, and Richard H. Savage, visited the lower valley to investigate the border problems and found "a state of lawlessness" that demanded "serious and immediate attention."[56] While travelling through the 125,000-square-mile area and recording the claims that were presented by hundreds of residents who had been victimized, a member of the committee witnessed Mexican bandits crossing the Rio Grande with cattle that had been stolen from the American side.[57] The committee processed American claims that totalled almost $28,000,000 and concluded that Mexico would always serve as a refuge for bandits and a sanctuary for stolen cattle and goods as long as the Mexican government remained uncooperative.[58] Almost two years after the committee had completed its investigation and left the valley, 32 Mexican bandits plundered the small village of Nuecestown, only 12 miles from Corpus Christi or about 200 miles from the Rio Grande.[59] Later, during the same year, a small group of frustrated Texans attempted to provoke a war with Mexico. To deter Mexican bandits from crossing the river and to display the American flag, the USS *Bravo,* with a crew of eight officers and 55 men, was dispatched to the Rio Grande. Although the elaborate plot that called for the *Bravo* to fire on Mexican territory failed, many Texans supported it with the faint hope that the United States might extend its border south into Mexico as far as the Sierra Madre Mountains.[60]

The next three decades were a period of tranquility along the border. The arrival of more settlers on both sides of the river made it more difficult for raiders to escape unnoticed and unapprehended. The improved condition of the Mexican Army was also an important factor.[61] Improved transportation on the American side, including newer roads and especially the completion of some railroad lines, increased the

ability of the ranchers to get their cattle to market quickly.[62] Internal problems in Mexico and Victoriano Huerta's San Diego Plan that called for an uprising of Mexican-Americans along the Rio Grande forced Governor Ferguson to call for federal assistance in 1915. A few vigilante groups appeared that summer, but calm returned to the valley that fall.[63] The end of the border raids and the accompanying violence allowed a long-needed period of stabilization and development for the border region.

Most of the economic development in south Texas occurred in the eastern end of the Rio Grande valley. The King Ranch, established in the late 19th century, continued to expand and provided the needed impetus to others who were interested in stock raising.[64] Land developers sold large tracts of the central valley for retirement homesites in the 1920s, and the first important citrus groves were planted in the same region during this period.[65] A large reliable irrigation system, long needed to turn the whole valley into a winter vegetable garden, was finally completed about the same time, but it served only the central and eastern parts of the valley.[66] Winter tourists, fleeing the cold weather of the upper midwest and the east coast, brought needed revenue into south Texas. As the transportation system improved, more hotels and restaurants appeared, along with golf courses, swimming pools, and other amusements. In more recent years, better highways, as well as the attractions of the Padre Island National Seashore and the border cities of Matamoros and Reynosa, have served as attractions for millions of tourists and their dollars.[67]

The far western end of the valley survives almost as it was in the late 19th century. Roma continues as a trading center for western Starr County and as a gateway to Mexico. Salineño, a small village on the Rio Grande, has remained virtually unchanged and without any modern industrial or commercial development. As the oldest town in the county, it still has the stand of large Mexican cypress trees that are located on the river just north of town and it still commands the best ford across the river, El Cantaro.[68] V. Havard mistakenly identified these trees as *Taxodium distichum* when he surveyed the flora of the Rio Grande valley in 1885. He observed they were "quite sparse" but found them as far away as Edinburg.[69] Havard confused the cypress he observed with the *Taxodium mucronatum* that continues to grow on one small section of the river bank to a height of over 40 feet. Away from the river, large ranches and numerous oil and gas wells dominate the western end of the county. The seven largest employers in Starr County are oil and gas producers. This indicates the important role that new industry plays in the county.[70] The new United States Highway 83 continues to serve as a link with the lower valley to the southeast and with Zapata and Laredo to the north. Historically, Starr County since its creation in 1848 has been a quiet place, not by choice, but because its location has not brought it the attention or the interest that the other valley counties have received.

The one important exception to this statement took place on December 15, 1950, when, pursuant to the terms of a 1944 Treaty between the United States and Mexico, construction began on a large dam on the Rio Grande at the far northern end of the county. Built under the direction of the International Boundary and Water Commission, Falcon Dam was dedicated on October 19, 1953. It is over 26,000 feet long, 150 feet above the riverbed, with a width of 1,000 feet at the bottom, tapering to only 35 feet in width at the top. It consumed over 12.5 million cubic yards of earth, 282,000 cubic yards of concrete, and over 10,000 tons of reinforcing steel to form a reservoir that can store over four million acre feet of water. The first electric power produced from the six 10,500-kilowatt generators was available on October 11, 1954. The cost of construction to the United States was about $35,000,000, but the flood control benefits to the United States alone as of January 1, 1971, amounted to over three times that figure. In addition to providing protection from dangerous and costly floods, the dam provides water for irrigation projects, inexpensive hydroelectric power, and an unsurpassed recreation area.[71]

While the construction of Falcon Dam did provide employment for many people in Starr County in addition to many other benefits, it also provoked a controversy and serious problems of relocation of residents and towns. The site of the reservoir (Falcon Lake) behind the dam flooded the towns of Zapata, the county seat of Zapata County, Guerro on the Mexican side, and Lopeno, near the dam. All had to be physically relocated on higher ground. The residents of the American towns, angered over the appraisals that had been approved for their homes, had to accept these decisions as the lake filled faster than anyone had anticipated. Despite numerous warnings, many residents fled the rising waters at the last moment carrying with them a few personal belongings. They were assigned homesites in the new town that corresponded as closely as possible to the sites they left in the previous location. The Mexican government handled the same situation in what many considered a more equitable manner when it assigned plots of land and then attempted to construct homes similar to the ones that their citizens had lost because of the dam's construction. Today, more than 20 years

later, the physical scars are gone, but many residents of Zapata are still unhappy over the way the United States government treated them.[72]

Despite the new dam, a growing number of tourists, and an improved transportation system, western Starr County along the Rio Grande remains a quiet, peaceful, largely undisturbed area. Mexican-American people still dominate the population statistics and comprise 97.9% of the total population of the county, according to the 1973 estimate.[73] Here, as elsewhere, there are many problems, although many of the powerful positions in all levels of government are Mexican-American controlled. In 1974, the unemployment rate for Chicanos was 21.7% as compared to 12% for the other residents of the valley.[74] Farm labor problems have gained national attention for the valley in recent years, while as symbol of authority, the Texas Rangers continue to patrol the area and are accused by some of occasionally harassing the residents.[75] With the Mexican-American population growing at a rate four times the rate of other groups in the valley, it will be interesting to observe the direction the valley takes. A historic and often violent border region can either move toward continuing the economic and industrial development that has already taken place, or, like most of western Starr County, relax and enjoy an uninterrupted siesta while the rest of the world continues to chase the illusive idea of success and temporary happiness. Perhaps the residents of the quiet village of Salineño have arrived at the answer.

NOTES

1. The best general survey of the Rio Grande Valley is J. Lee and Lillian J. Stambaugh, *The Lower Rio Grande Valley of Texas* (San Antonio, 1954). Less substantial and rather dated is Frank C. Pierce, *A Brief History of the Lower Rio Grande Valley* (Menasha, Wisconsin, 1917). More specialized studies are contained in other notes.

2. Mrs. Egbert Viele, *Following the Drum: A Glimpse of Frontier Life* (New York, 1858), 151, 152.

3. River Basin Surveys, Smithsonian Institution, *Archeological Excavations at the Falcon Reservoir, Starr County, Texas* (n.p., 1951), 25-26.

4. Alex D. Krieger and Jack T. Hughes, "Archaelogical Salvage in the Falcon Reservoir Area: Progress Report No. 1 (typescript, 1950), Alex D. Krieger Reports, University of Texas Archives, Austin, Box 2R72.

5. W. W. Newcomb, Jr., *The Indians of Texas: From Prehistoric to Modern Times* (Austin, 1961), Map 1, 35.

6. *Ibid.*, 32-33; 30; 40-41.

7. *Ibid.*, 39; 40-41.

8. For more information of the Coahuiltecans of south Texas, see W. W. Newcomb's excellent and detailed Chapter 2, "Savages of the Western Gulf Culture Area; The Coahuiltecans: South Texas," in *The Indians of Texas,* 29-58.

9. Newcomb, *The Indians of Texas,* 56.

10. *Ibid.*, 36-37.

11. Florence J. Scott, *Historical Heritage of the Lower Rio Grande: A Historical Record of Spanish Exploration, Subjugation, and Colonization of the Lower Rio Grande Valley and the Activities of Jose Escandon, Count of Sierra Gorda, together with the Development of Towns and Ranchos under Spanish, Mexican, and Texas Soverieignties, 1747-1848* (rev. ed., Waco, 1966), 1-4.

12. See Lawrence F. Hill, *Jose de Escandon and the Founding of Nuevo Santander, A Study in Spanish Colonization* (Columbus, 1926) for an excellent summary based on MSS sources; Scott, *Historical Heritage of the Lower Rio Grande,* 5-9, and see Eugene George, *Historic Architecture of Texas: The Falcon Reservoir* (Austin, 1975), 7-17.

13. Scott, *Historical Heritage of the Lower Rio Grande,* Ch. 2 "Organization of the Province of Nuevo Santander," 11-24.

14. Polly P. Crawford, "The Beginning of Spanish Settlements in the Lower Rio Grande Valley," unpublished MA Thesis, University of Texas, 1925, Ch. 2 "The Reconnaissance," 16-43.

15. Hill, *Jose de Escandon,* 97-98.

16. Scott, *Historical Heritage of the Lower Rio Grande,* 40, and Hill, *Jose Escandon,* 100.

17. Crawford, "The Beginning of Spanish Settlements," Ch. 6 "Hacienda de Dolores," 153-160; Scott, *Historical Heritage of the Lower Rio Grande,* 39-40; and Hill, *Jose de Escandon,* 100-101.

18. Hill, *Jose de Escandon,* Ch. 6 "The State of the Province in 1757," 106-135.

19. Scott, *Historical Heritage of the Lower Rio Grande,* Ch. 5 "The General Visit of the Royal Commission of 1765," 60-98. See a listing of the *porciones* of Revilla, 77-81 and of Mier, 81-83. See also the interesting map on 79.

20. *Ibid.*, Ch. 6 "Large Grants on the Rio Grande," 99-119.

21. *Ibid.*, 114-117.

22. David M. Vigness, ed. and trans., "Nuevo Santander in 1795: A Provincial Inspection by Felix Calleja," *South-*

western Historical Quarterly, 75 (April, 1972), 491; 491-506; 478-485.

23. Leroy P. Graf, "Colonizing Projects in Texas South of the Nueces, 1820-1845," *Southwestern Historical Quarterly,* 50 (April 1947), 437-440.

24. Carl C. Rister, "Rio Grande Colony," *Southwest Review,* 25 (June, 1940), 429-441.

25. Graf, "Colonizing Projects in Texas," 441-444.

26. David M. Vigness, "Indian Raids on the Lower Rio Grande, 1836-1837," *Southwestern Historical Quarterly,* 59 (July, 1955), 14-23.

27. Stambaugh and Stambaugh, *The Lower Rio Grande Valley of Texas,* 49-51.

28. David M. Vigness, "The Republic of the Rio Grande: An Experiment in Separatism in Northern Mexico," unpublished PhD dissertation, University of Texas, 1951; Justin Smith, "La Republica de Rio Grande," *American Historical Review,* 25 (July, 1920), 660-675; Jovita Gonzalez, "Social Life in Cameron, Starr, and Zapata Counties," unpublished MA thesis, University of Texas, 1930, 13-15; and David M. Vigness, "Relations of the Republic of Texas and the Republic of the Rio Grande," *Southwestern Historical Quarterly,* 57 (January, 1954) 312-321.

29. Ralph A. Wooster, "Texas Military Operations Against Mexico: 1842-1843," *Southwestern Historical Quarterly,* 67 (April, 1964), 465-484; Bernice Barker, "The Texas Expedition to the Rio Grande in 1842," unpublished MA thesis, University of Texas, 1929, Ch. 3 "General Somervell's Expedition to the Rio Grande," 24-39; and Sterling B. Hendricks, "The Somervell Expedition Down the Rio Grande in 1842," *Southwestern Historical Quarterly,* 23 (October, 1919), 112-140.

30. Thomas J. Green, *Journal of the Texas Expedition Against Mier: Subsequent Imprisonment of the Author, His Sufferings, and Final Escape from the Castle of Perote, with References upon the Present and Possible Future Relation of Texas, Mexico, and the United States* (New York, 1845), 69-125; William P. Stapp, *The Prisoners of Perote: Containing a Journal Kept by the Author who was Captured by the Mexicans at Mier, December 25, 1842, and Released from Perote, May 16, 1844* (Philadelphia, 1845), 27-74; Virgil N. Lott and Virginia N. Fenwick, *People and Plots on the Rio Grande* (San Antonio, 1957), Ch. 10 "Myths of Mier," 79-88; David M. Vigness, "The Lower Rio Grande Valley, 1836-1846," unpublished MA thesis, University of Texas, 1948, Ch. 4 "The Mier Expedition, 1842-1843," 107-133; and J. J. McGrath and Wallace Hawkins, "Perote Fort-Where Texans Were Imprisoned," *Southwestern Historical Quarterly,* 48 (January, 1945), 340-345.

31. Virgil N. Lott and Mercurio Martinez, *Kingdom of Zapata* (San Antonio, 1953), 98-100.

32. *Ibid.,* 41-44.

33. W. A. McClintock, "Journal of a Trip Through Texas and Northern Mexico, 1846-1847," *Southwestern Historical Quarterly,* 34 (January, 1931), 238.

34. I. J. Cox, "The Southwest Boundary of Texas," *The Quarterly of the Texas State Historical Association,* 6 (October, 1902), 102.

35. For a detailed summary of the Mexican War, see Justin H. Smith, *The War with Mexico* (2 vols., New York, 1917); Robert S. Henry, *The Story of the Mexican War* (Indianapolis, 1950); and Glenn W. Price, *Origin of the War with Mexico: The Polk-Stockton Intrigue* (Austin, 1967). For a shorter summation, see Otis A. Singletary, *The Mexican War* (Chicago, 1960) or William H. Goetzmann, *When the Eagle Screamed: The Romantic Horizon in American Diplomacy, 1800-1860* (New York, 1960). See Ronnie C. Tyler, *The Mexican War: A Lithographic Record* (Austin, 1973) for an excellent collection of pictures of the war.

36. William G. Freeman, "W. G. Freeman's Report on the Eighth Military Department," ed. M. L. Crimmins, *Southwestern Historical Quarterly,* 52 (January, 1949), 349-351.

37. William H. Emory, "Report of William H. Emory," U.S., Congress, House of Representatives, 34 Cong., lst. Sess., H. Exec. Doc. No. 135, Vol. 1, 66-67.

38. Harbert Davenport, "Notes on Early Steamboating on the Rio Grande," *Southwestern Historical Quarterly,* 49 (October, 1945), 286-287.

39. Bryant P. Tilden, *Notes on the Upper Rio Grande* (Philadelphia, 1847), Map 4.

40. *Ibid.,* 10-16.

41. *Ibid.,* 23-24; 8.

42. "Commerce on the Rio Grande," *De Bows Review,* 28 (February 14, 1860), 460.

43. *Ibid.,* 461.

44. Leroy P. Graf, "The Economic History of the Lower Rio Grande Valley, 1820-1875," unpublished Ph.D dissertation, Harvard University, 1942, 214-221.

45. John R. Stevens, *The Valley of the Rio Grande: Its Topography and Resources* (New York, 1864), 25; 5-6. Originally published as "Reoccupation of the Rio Grande," New York *Tribune,* December 8, 1864.

46. *Ibid.,* 27.

47. Graf, "The Economic History of the Lower Rio Grande Valley," 263-266; 261-263 and Emory, "The Report of William H. Emory," Vol. 1, 64.

48. Charles W. Goldfinch, *Juan N. Cortina, 1824-1892: A Reappraisal* (Brownsville, Texas, 1950), 9-28; 42-50; P. F. Parisot, *The Reminiscences of a Texas Missionary* (San

Antonio, 1899), 97-99; J. Fred Rippy, "Border Troubles Along the Rio Grande," *Southwestern Historical Quarterly,* 23 (October, 1919), 104-111 and Frank Halla, "South Texas Border Raids: An Appraisal," unpublished typescript, University of Texas, 1970.

49. U.S., Congress, House of Representatives, "Troubles on Texas Frontier," 36 Cong. 1st Sess., House Exec. Doc. No. 81, 24-25.

50. U.S., Congress, Senate, "Hostilities on the Rio Grande," 36 Cong., lst. Sess., Senate Exec. Doc. No. 21, 2.

51. U.S., Congress, House of Representatives, "Depredations on the Rio Grande," 43 Cong., lst Sess., House Exec. Doc. No. 257, 4-5.

52. U.S., Congress, House of Representatives, "Trouble on Texas Frontier," 19.

53. U.S., Congress, House of Representatives, "Depredations on the Rio Grande," 4-12.

54. U.S., Congress, House of Representatives, "Relations of the United States and Mexico," 45 Cong., 2nd. Sess., House Committee Report No. 701, Vol. 2, 7.

55. Michael G. Webster, "Intrigue on the Rio Grande: The *Rio Bravo* Affair, 1875," *Southwestern Historical Quarterly,* 74 (October, 1970), 151-152.

56. U.S., Congress, House of Representatives, "Depredations on the Frontier of Texas," 42 Cong., 3rd Sess., House Exec. Doc. No. 39, 2.

57. *Ibid.,* 44-63; 18-19; 39.

58. *Ibid.,* 39; 8; 6; 22-24.

59. Webster, "Intrigue on the Rio Grande," 152.

60. *Ibid.,* 155-160.

61. Robert D. Gregg, "The Influence of Border Troubles on Relations Between the United States and Mexico, 1876-1910," *John Hopkins University Studies in Historical and Political Science,* 55(1937), No. 3, 510-512.

62. *Ibid.,* 155-160.

63. Charles Cumberland, "Border Raids in the Lower Rio Grande Valley, 1915," *Southwestern Historical Quarterly,* 57 (January, 1954), 285-311.

64. See Tom Lea, *The King Ranch* (2 vols.), Boston, 1957.

65. See G. G. Parrish, "A History of the Rio Grande Valley Citrus Industry," unpublished MA thesis, Texas College of Arts and Industries, 1940.

66. Arthur C. Bowman, "The History and Present Status of Water Utilization on the Rio Grande," unpublished Ph.D dissertation, University of Texas, 1955; William K. Matthews, "A History of Irrigation in the Lower Rio Grande Valley," unpublished MA thesis, University of Texas, 1938; Mrs. J. L. McNail, "The History and Development of Irrigation in the Lower Rio Grande Valley," unpublished MA thesis, Texas College of Arts and Industries, 1948; and George N. Coffey *et al., Reconnaissance Soil Survey of South Texas* (Washington, 1909), 1107-1110.

67. For promotional ideas on the valley, see Harry Foehner, "The Valley Steps Out: Air, Deep Water, and Highway Transportation Are Putting the Lower Rio Grande Country in Touch with the World," *Texas Monthly,* 6 (July, 1930), 38-44; P. J. R. MacIntosh, "The Magic Valley: An Account of the Development in the Rio Grande Valley and Its Outlook," *Texas Monthly,* 1 (February, 1928), 214-239; Victor Schoffelmayer, "The Magic Valley–Its Marvelous Future," *Texas Geographic Magazine,* 3 (Spring, 1939), 16-31; and J. Lee Stambaugh, "The Lower Rio Grande Valley: A Study of the Economic Development of the 'Magic Valley' and Its Future," *Texas Monthly,* 3 (June, 1929), 747-760.

68. Interview with Mrs. Florence Scott, Rio Grande City, Texas, July 23, 1975.

69. V. Havard, "Report on the Flora of Western and Southern Texas," *Proceedings of the United States National Museum,* 8(1885), No. 29, 475. See also, Jack M. Inglis, *A History of Vegetation on the Rio Grande Plain* (Austin, 1964), 68-69 for other early travellers who crossed Starr County.

70. Starr County Industrial Foundation, *Progress Unlimited* (Rio Grande City, Texas, n.d.), 6.

71. International Boundary and Water Commission, *Falcon Dam and Power Plant* (El Paso, 1971), 3-4.

72. Patsy J. Byfield, "The Building of Falcon Dam and the Relocation of Five Communities in Zapata County, Texas," unpublished MA thesis, University of Texas, 1966, Ch. 2 "The Building of the Dam and Reservoir," 27-79 and Ch. 3 "The Floods and Their Aftermath," 80-135. Also edited and published as *Falcon Dam and the Lost Towns of Zapata* (Austin, 1966). For a detailed discussion of the negotiations over this and other international dams, see Norris W. Hundley, Jr., *Dividing the Waters: A Century of Controversy Between the United States and Mexico* (Berkeley, 1966). See George, *Historic Architecture of Texas,* for an excellent coverage of the submerged structures of the area that includes a number of valuable photographs and drawings.

73. Starr County Industrial Foundation, *Progress Unlimited,* 2.

74. Robert Coles, "Our Hands Belong to the Valley," *Atlantic Monthly,* 235 (March, 1975), 72.

75. *Ibid.*

THE GEOLOGIC ENVIRONMENT OF THE RIO GRANDE-FALCON THORN WOODLANDS, STARR COUNTY, TEXAS

Dwight Deal

INTRODUCTION

The Rio Grande-Falcon thorn woodlands study area (Fig. 1) is an approximately 20-km (about 10-mile) reach of the Rio Grande immediately downstream from Falcon Dam and approximately 130 km (80 miles) downstream from Laredo, Texas. This is a nearly pristine remnant of the riparian thorn woodland, associated with upland Tamaulipan brush, that once occurred along most of the lower Rio Grande valley. Smaller, relatively undisturbed remnants occur at Santa Ana National Wildlife Refuge, Auzalduas, the Bentsen-Rio Grande Valley State Park. The study area below Falcon Dam is the most extensive contiguous remnant of this tropical woodland remaining in the United States.

The strata that underlie the study area are of Eocene age. Exposed near the river are yellowish-weathering sandstone ledges of the Crockett Formation (Fig. 2). Farther from the river are hills of the younger overlying soft clays of the Yegua Formation. Still younger sediments, deposited during Quaternary time by the Rio Grande, dominate the landscape in the immediate vicinity of the river. These sediments include both the modern floodplain deposits and older river-deposited terrace sands and gravels. The older sands and gravels are cut into and overlie the Eocene bedrock.

The river and the sediments deposited by it are the most important geological components of the subtropical thorn woodland study area. Most of the interest in this study area is directed toward the biological and cultural resources, most of which occur in association with the young Rio Grande sediments. This report is, therefore, designed to provide a background understanding of the geology of the study area for nongeologists and to provide supportive information for the other reports on this area prepared for the Natural Areas Survey of The University of Texas at Austin Center for Natural Resources and Environment.

A general description of the geology of Falcon State Recreation Park has been written by Maxwell (1970:87-91), and a description of the underlying bedrock units is given by Sellards and others (1932:655-677). Users of this report unfamiliar with geological terminology may find it useful to refer to the Glossary of Geology (Gary and others 1972).

ACCESS

All of the study area lies within a few miles of U.S. Highway 83. Paved roads provide access to the northern end of the study area at Falcon Dam and to the central part of the study area at the town of Salineño. Graded county roads provide access to the southern portion of the study area in the vicinity of Santa Margarita. Private roads provide additional entry to most of the area, and the cooperation of the numerous local residents who allowed us to use these roads is greatly appreciated.

PHYSIOGRAPHY

This reach of the lower Rio Grande lies well within the coastal plain physiographic province and is considered by the U.S. Department of Agriculture to be the upstream end of the Rio Grande Bottomlands Land Resource Area of Texas (Texas A&M University 1973: Fig. 3).

Erosion by the Rio Grande and its tributaries has trenched the land surface from above Laredo to near the Starr-Hidalgo county line. The resultant belt of maximum erosion, in the vicinity of the study area, formed the Rio Grande gorge and an area known generally as the Breaks of the Rio Grande. The most spectacular part of the Rio Grande gorge occurred in southern Zapata County and is now submerged beneath the waters of Falcon Reservoir.

The uplands above the river are gently rolling, developed on the clays of the Yegua Formation, with occasional more resistant gravel caps that are remnants of former terrace gravels.

The topography of the study area is shown on three 7.5-minute U.S.G.S. topographic maps: Falcon Village, Roma-Los Saenz West, and Salineño. Elevations range from a low of about 47 m (155 ft) along the Rio Grande in the vicinity of Fronton to highs in excess of 115 m (380 ft) on the hills east of the river. The spillway elevation of Falcon Dam is about 96 m

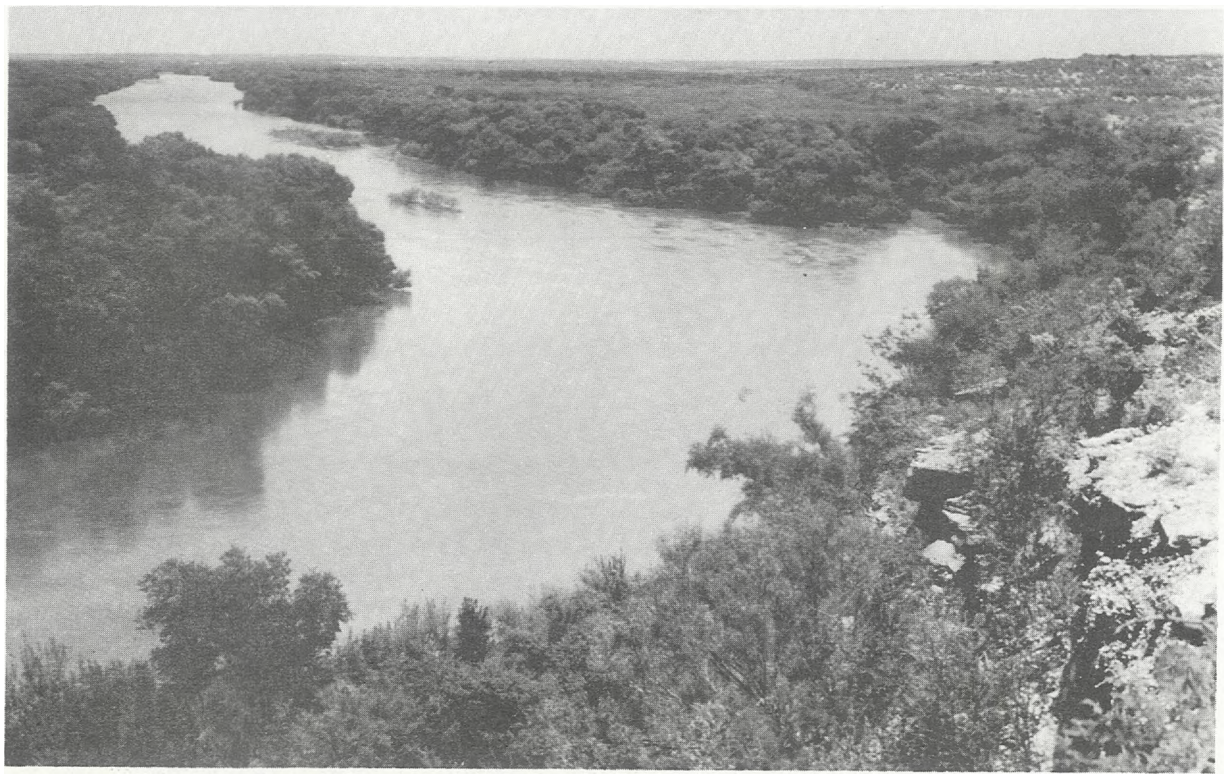


FIGURE 1

Thorn woodlands developed on the higher floodplain and lower terraces of the Rio Grande. View upstream from a gravel-capped higher terrace about 13 km below Falcon Dam. Buildings at Salineno are visible in the distance. Photo by Dwight Deal.

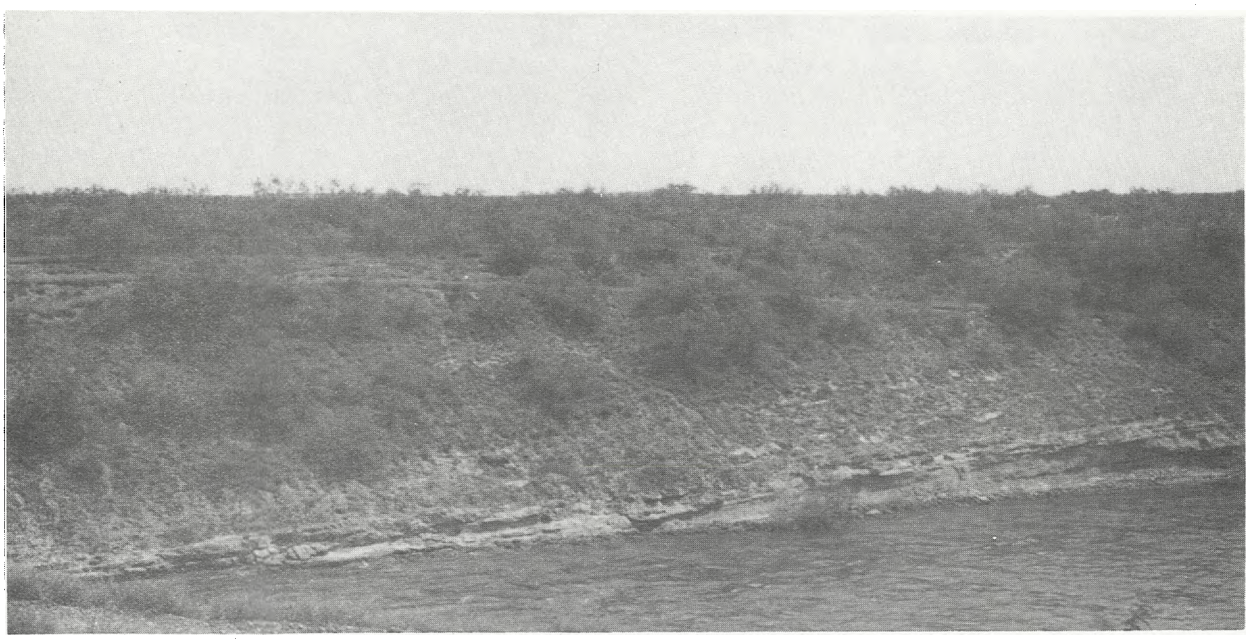


FIGURE 2

Sandstone ledges exposed along the spillway below Falcon Dam. Photo by Dwight Deal.

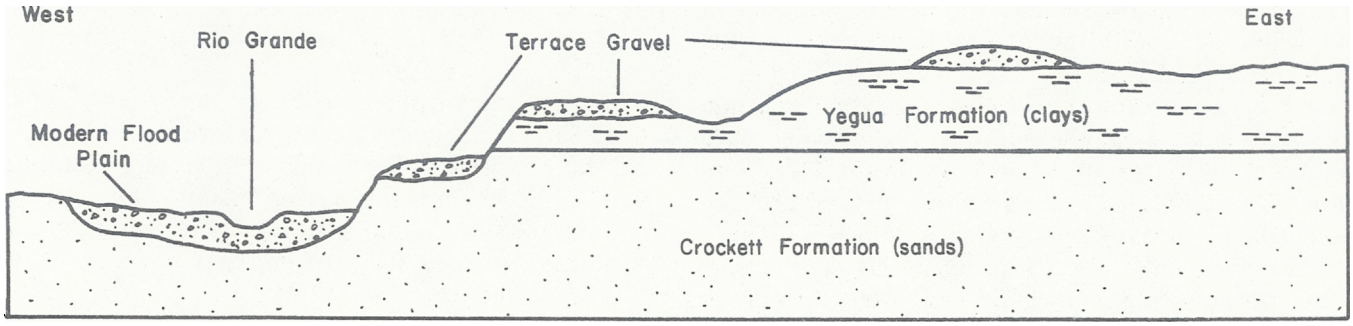


FIGURE 3

Diagramatic geologic cross-section of the Thorn Woodlands study area.

(314 ft) and the normal pool elevation of Falcon Reservoir is about 90 m (296 ft). The river elevation below the spillway is approximately 56 m. The gradient of the Rio Grande below Falcon Reservoir through the study area is slightly less than 0.5 m per km (slightly more than 2 ft per mile).

CLIMATE

The lower Rio Grande valley has the most uncomfortable summer weather of any place in the United States. This fact has been discussed in length by Hurt (1975) in a popular article in *Texas Monthly*. Temperature measurements alone (Table 1) do not justify this extreme judgment, but the fact that the area experiences high humidity (Table 2) at the same time does. The combination of high humidity and high temperature seriously affects the temperature regulatory mechanisms of the human body, especially when outside temperatures exceed body temperatures. There are several ways of measuring this discomfort effect: one is "effective temperature." Effective temperature considers, along with temperature, the effects of humidity and air movement. Folk (1974:50) in his text on the adaptation of man to climatic conditions, states:

> A review of worldwide effective temperature data for summer reveals that the Red Sea and the Indus Valley are the worst. In the United States the lower Rio Grande Valley and a section of the Gulf Coast are the worst. These values are even worse than those for typical tropical areas, such as Devil's Island in Guiana.

Another comparison measure is "desert equivalent temperature," an abstract figure derived by comparing the real atmosphere to a fixed water vapor density of 10 gr per m^3 rather than to a saturated atmosphere. The lower Rio Grande Valley has an average (day and night) summer desert equivalent temperature of about 39°C (102°F), the hottest in Texas. By comparison the average summer desert equivalent temperature in Death Valley is body temperature, a cooler 37°C (98.6°F) (Hurt 1975:50).

The uncomfortable weather in the lower Rio Grande Valley is caused by warm air from the Mexican desert, warm air from the Gulf of Mexico, and the relatively high humidity. The lower Rio Grande Valley in the vicinity of Falcon Dam is close enough to the Gulf to pick up marine moisture but too far inland to benefit from cooling sea breezes. Table 1 shows the temperature records for Falcon Reservoir, Table 2 lists the mean relative humidity, Table 3 shows the evaporation rate, and Table 4 lists the rainfall data. It is interesting to note that even though the area has high relative humidity, the evaporation rates far exceed precipitation.

RIVER FLOW

The construction of Falcon Dam began in 1950 and was completed on April 18, 1954. Water started to be retained behind the dam on August 25, 1953. Almost all of the current flow along the reach of the Rio Grande in the study area is a function of the amount of water released from the dam. Historic records have been kept since 1900 at Roma, Texas, a few kilometers downstream from the study area. These records are reproduced in Table 5. The discharges since 1955 from Falcon Reservoir are summarized in Table 6. The three highest momentary extreme discharges recorded at Roma occurred in 1932, 1935, and 1948:

Date	Stage in Feet above Mean Sea Level	Discharge in Second-Feet
September 5, 1932	181.33	203,420
June 17, 1935	173.74	141,000
September 11, 1948	178.97	176,900

The highest annual discharge on record occurred in 1906 when 8,200,000 acre-feet of water passed the gauging station at Roma.

Since the construction of Falcon Dam, the extreme flows from records at the dam indicate a momentary maximum discharge of 82,600 second-feet on September 18, 1971, and a minimum momentary discharge of 1.5 second-feet on March 24 and 25, 1957. For the period from 1955 through 1973, the extreme average flow rates in second-feet below the dam are as follows (International Boundary and Water Commission Water Bulletin 43:56):

Daily	
Max. 76,400	September 18, 1971
Min. 1.5	March 24 and 25, 1957
Monthly	
Max. 32,500	October, 1958
Min. 23.5	November, 1973
Yearly	
Max. 6,930	1958
Min. 1,580	1970

Falcon Dam is a compacted, rolled-earth structure with a total length of 26,294 feet and 50 feet in height. The reservoir's summer storage capacity is 2,371,220 acre-feet with a surface area of 78,340 acres. Above the summer storage elevation, there are an additional 904,480 acre-feet for flood-control storage, and 40,000 acre-feet for conservation storage is allowed during the winter months (Dowell 1964:137-140; Maxwell 1970:87).

BEDROCK STRATIGRAPHY

Bedrock stratigraphic units that underlie the Rio Grande-Falcon thorn woodlands study area are summarized in Table 7 and Figure 3. They are all of Eocene age, and most belong to the Claiborne Group. They generally form north-south bands across the landscape, with the oldest formations exposed in the west and becoming progressively younger eastward. The rocks exposed in the area are mostly sands and clays that were deposited in a marine environment.

Claiborne Group

The name "Claiborne" was first used in the description of fossiliferous beds exposed in Claiborne Bluff on the Alabama River in Alabama (Tuomey 1850:150). Rocks belonging to the Claiborne Group underlie the entire Gulf coastal plain, and the name has been carried laterally across Texas. A number of formations have been named within this group. They are, from oldest to youngest: Carrizo Sandstone, Reklaw Formation, Queen City Formation, Weches Formation, Sparta Sandstone, Crockett Formation, and Yegua Formation.

Only the three youngest units—the Sparta, Crockett, and Yegua—are discussed in this report. The strata of the Claiborne Group contain alternating nearshore shallow-marine sediments and terrestrial swamp and river deposits, which reflect fluctuating positions of the Gulf of Mexico shoreline during Eocene time.

Sparta Sandstone. Sparta sand was first defined by Vaughan (1896:25-26) as deep quartz sand extending across Louisiana and well developed near Sparta in Bienville Parish. At one time these beds were defined as a lower part of the Cook Mountain Formation (Deussen 1914:56). The Cook Mountain Formation has since been subdivided into the lower Sparta Sandstone and the upper Crockett Formation.

The Sparta Sandstone underlies most of the study area but does not seem to be exposed; it is buried beneath the Rio Grande floodplain deposits and the overlying Crockett Formation. The Sparta Sandstone is a poorly consolidated sandstone with sandy shale and some clay, usually colored gray or buff.

Crockett Formation. The Crockett Formation is exposed in the study area along the Rio Grande gorge. It contains firmly cemented sandstone, some clay, fossiliferous limestone, and marine concretions. The sandstone usually forms ledges. Many beds in the Crockett Formation contain very abundant fossils, indicating its marine origin and contrasting to the other strata in the area that contain relatively few fossils. The marine beds above the Sparta sands were classified as part of the Cook Mountain Formation by Duessen (1914:56), which was named for the town of Cook Mountain in Houston County, Texas. The name Crockett was used by Ellisor (1929:1339-1340) for exposure in the vicinity of Crockett, also in Houston County.

Within the study area, the Crockett Formation characteristically is exposed as sandstone ledges near the Rio Grande; elsewhere, it typically forms rolling sandstone hills with red sandy soils, contrasting strongly with the dark soils developed on the overlying Yegua Formation.

Yegua Formation. The beds that occur in the geologic section above the Crockett Formation were originally named Fayette by Penrose (1890:47). The Yegua was first used by Dumble (1892) for exposures along Yegua Creek in Lee County, Texas. Since that time there has been considerable discussion about the proper use of the name in the literature (Sellards and others 1932:666-669); most of that controversy has now been resolved.

Most of the hills above the Rio Grande Valley are

developed on the Yegua Formation, a slightly fossiliferous marine clay that contains some weakly resistant beds of lignitic sandstone. The clays are typically dark chocolate brown to gray and greenish-gray. Fossils are found in most of the clay, but they are not so abundant as in the underlying Crockett Formation, nor is the number of species as great (Maxwell 1970:89). Also, the area underlain by the Yegua Formation is typically open prairie with a very dark soil.

Jackson Group

Above the Yegua Formation are a series of sandstones and clays deposited in both marine and nonmarine environments. Of interest is the fact that these beds contain a few thin layers of white volcanic ash that record volcanic eruptions, probably from a source area some distance to the west. The Jackson Group is not exposed in the study area. It is described in detail in Sellards and others (1932:677-699).

QUATERNARY DEPOSITS

Older Terrace Gravel Deposits

River-deposited gravels occur throughout the study area. The highest such deposits shown on the photogeologic map that accompanies this report occur along U.S. Highway 83 between 100 and 110 m (300-330 ft) above sea level. The most extensive high terrace remnant is in the southern half of the study area, south of the community of Santa Margarita and north of Arroyo la Minita. These gravels occur at elevations between 90 and 95 m (250-290 ft) above sea level. They are typically 3 m (20 ft) or more thick at any given exposure and, in their upper part, commonly cemented by soil-deposited calcium carbonate (caliche). The caliche zone occasionally reaches two m in thickness. South of Santa Margarita, at least two lower terrace gravel remnants occur between 65 and 90 m (200-250 ft) above sea level.

Higher Floodplain and Younger Terrace Deposits

A prominent, broad (in places more than one km wide) higher floodplain surface occurs 8 to 12 m above the normal height of the Rio Grande. Although this surface is rarely inundated, the possibility of flooding under extreme flow conditions is distinctly possible. At the International Bridge at Roma, the Rio Grande rose more than 10 m during the September 5, 1932 flood. Sediments in this terrace deposit are typically silt, sand, and gravel, with some clay.

Lower Floodplain and Modern Channel Deposits

Lower floodplain and modern channel deposits are quite similar to the higher floodplain and younger terrace deposits described above but normally contain less clay and are less well-anchored by plant roots. The areas underlain by these deposits are commonly inundated during times of high river flow.

Slope and Sidestream Deposits

A mixture of slope deposits (colluvium) and sidestream deposits (alluvium) can be distinguished on aerial photographs due to their lighter tone and are shown on the photogeologic map of the area. These deposits typically contain stream-deposited sand and silt mixed with silt and clay transported by slope processes from the topographically-higher Yegua Formation and the B horizon of the surrounding soils.

BIBLIOGRAPHY

Deussen, A. 1914. *Geology and underground waters of the southeastern part of the Texas coastal plain.* U.S. Geological Survey Water Supply Paper 335, 365 pp.

Dowell, C. L. 1964. *Dams and reservoirs in Texas.* Austin: Texas Water Commission Bulletin 6408, 248 pp.

Dumble, E. T. 1892. *Report on the Brown coal and lignite of Texas: character, formation, occurrence, field use.* Austin: Texas Geological Survey, 243 pp.

Ellison, A. 1929. Correlation of the Claiborne of east Texas with the Claiborne of Louisiana. *American Association of Petroleum Geologists Bulletin 13,* pp. 1335-1346.

Folk, G. E. 1974. (ed. by N. Balfour Slonim) *Environmental Physiology.* C. V. Mosby, St. Louis.

Gary, M., McAffey, R, Jr., and Wold, C. L., Editors. 1972. *Glossary of Geology.* Washington, D.C.: American Geological Institute, 1055 pp.

Hurt, H. III. 1975. The Hottest Place in the USA. *Texas Monthly,* August 1975, pp. 50-53, 84-93.

International Boundary and Water Commission. 1956-1972. *Flow of the Rio Grande and related data.* International Boundary and Water Commission Water Bulletins, Nos. 25-43.

———. 1955. *Flow of the Rio Grande and related data, 1889-1955,* International Boundary and Water Commission Summary Water Bulletin No. 1.

Maxwell, R. A. 1970. *Geologic and Historic Guide to the State Parks of Texas.* Bureau of Economic Geology, Guidebook 10. The University of Texas at Austin.

Penrose, R. A. F., Jr. 1890. A preliminary report on the geology of the Gulf Tertiary of Texas from Red River to the Rio Grande, Texas. *U.S. Geological Survey Annual Report No. 1,* pp. 3-101.

Sellards, E. H., Adkins, W. S., and Plummer, F. B. 1932. *The Geology of Texas, Vol. 1.* Bureau of Economic Geology, Bulletin 3232, The University of Texas, Austin.

Texas A&M University. 1973. *General Soil Map of Texas.* Texas Agricultural Experiment Station, Texas A&M University.

Tuomey, M. 1850. *First biennial report on the geology of Alabama.* Alabama Geological Survey.

Vaughn, T. W. 1896. *A brief contribution to the geology and paleontology of northwestern Louisiana.* U.S. Geological Survey, Bulletin 142.

TABLE 1

TEMPERATURE (FAHRENHEIT) AT FALCON DAM

(Data from The International Boundary and Water Commission Water Bulletins 34-43)

		Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Yearly
	Max	87.0	85.0	94.0	100.0	106.0	98.0	102.0	102.0	101.0	95.0	92.0	89.0	106.0
1973	Min	25.0	27.0	45.0	41.0	55.0	64.0	70.0	68.0	65.0	54.0	35.0	19.0	19.0
	Mean	51.6	52.2	68.1	68.9	76.5	78.8	81.7	78.5	78.3	71.6	67.4	56.1	69.1
	Max	91.0	89.0	97.0	105.0	93.0	100.0	100.0	103.0	103.0	95.0	95.0	92.0	105.0
1972	Min	31.0	28.0	43.0	49.0	65.0	67.0	70.0	68.0	69.0	52.0	39.0	33.0	28.0
	Mean	57.3	57.3	62.9	76.4	74.4	79.1	80.3	83.1	81.4	73.2	56.7	53.1	69.6
	Max	96.0	92.0	100.0	101.0	99.0	103.0	104.0	100.0	103.0	91.0	92.0	85.0	104.0
1971	Min	33.0	32.0	33.0	47.0	57.0	69.0	69.0	72.0	59.0	55.0	41.0	39.0	32.0
	Mean	61.7	61.3	68.0	71.6	79.2	81.4	81.9	79.7	77.9	72.6	64.6	60.4	71.7
	Max	81.0	85.0	94.0	103.0	97.0	108.0	103.0	105.0	103.0	93.0	87.0	88.0	108.0
1970	Min	25.0	33.0	39.0	51.0	53.0	60.0	71.0	69.0	55.0	44.0	31.0	40.0	25.0
	Mean	48.6	57.5	61.5	74.6	74.8	80.5	83.3	85.0	77.0	65.5	59.7	63.8	69.3
	Max	92.0	88.0	94.0	97.0	102.0	108.0	108.0	105.0	100.0	101.0	99.0	80.0	108.0
1969	Min	33.0	43.0	37.0	51.0	52.0	65.0	72.0	71.0	60.0	50.0	33.0	39.0	33.0
	Mean	60.9	63.0	63.7	79.2	83.7	88.2	92.4	90.4	86.7	76.1	61.9	57.9	75.3
	Max	84.0	81.0	87.0	99.0	98.0	102.0	100.0	105.0	101.0	95.0	89.0	89.0	105.0
1968	Min	31.0	30.0	33.0	47.0	60.0	66.0	69.0	68.0	62.0	51.0	35.0	31.0	30.0
	Mean	55.8	55.8	64.4	74.8	82.8	84.7	85.5	88.1	81.3	77.2	66.3	61.7	73.2
	Max	86.0	88.0	100.0	104.0	110.0	106.0	104.0	106.0	101.0	87.0	92.0	82.0	110.0
1967	Min	26.0	29.0	39.0	61.0	56.0	66.0	68.0	65.0	49.0	44.0	40.0	30.0	26.0
	Mean	55.6	58.6	71.2	80.0	81.3	85.0	86.4	82.1	76.7	70.6	63.7	55.4	72.2
	Max	81.0	83.0	94.0	95.0	97.0	99.0	103.0	104.0	106.0	106.0	92.0	88.0	106.0
1966	Min	27.0	33.0	37.0	51.0	57.0	62.0	69.0	69.0	64.0	47.0	34.0	26.0	26.0
	Mean	52.9	56.7	57.3	76.9	78.7	83.4	88.0	87.4	84.4	74.0	69.5	58.6	73.2
	Max	90.0	89.0	96.0	98.0	100.0	105.0	109.0	102.0	102.0	93.0	91.0	81.0	109.0
1965	Min	33.0	33.0	33.0	56.0	58.0	72.0	70.0	68.0	61.0	49.0	47.0	38.0	33.0
	Mean	58.9	58.0	64.1	78.7	82.3	87.4	89.4	88.5	85.0	73.8	74.2	64.3	75.4
	Max	84.0	83.0	97.0	102.0	101.0	102.0	104.0	106.0	102.0	93.0	91.0	89.0	106.0
1964	Min	28.0	32.0	41.0	49.0	62.0	64.0	70.0	74.0	63.0	48.0	41.0	33.0	28.0
	Mean	53.7	53.6	66.0	75.6	78.2	81.2	85.5	86.5	80.0	69.0	65.1	53.7	70.7
Average 1950-1973		56.4	60.0	67.0	75.4	80.0	84.1	86.2	85.9	81.4	73.7	64.2	58.0	72.7

TABLE 2

MEAN RELATIVE HUMIDITY (PERCENT) AT FALCON DAM

(Data from the International Boundary and Water Commission Water Bulletins 34-43)

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Yearly
1973	65.2	68.1	60.6	61.9	56.5	66.3	62.1	65.9	68.5	69.6	68.3	55.3	64.0
1972	67.4	65.4	63.5	57.2	69.0	67.6	62.6	55.1	60.0	63.2	63.4	63.3	63.1
1971	58.5	55.3	49.6	53.2	57.9	59.6	58.5	65.5	71.7	75.8	68.7	73.8	62.3
1970	81.6	68.1	63.2	62.8	63.7	63.7	61.2	60.5	71.4	66.5	54.5	65.4	65.2
1969	70.0	71.5	69.8	65.7	68.3	66.8	62.3	63.3	70.2	72.0	70.4	76.6	68.9
1968	80.1	75.3	73.0	74.6	72.8	70.0	72.2	67.6	76.1	74.3	71.3	64.5	72.6
1967	65.0	62.8	66.3	64.0	61.2	61.4	60.3	71.9	74.9	69.6	81.8	74.6	67.8
1966	87.4	73.3	65.5	66.3	74.4	69.1	61.0	58.7	64.5	71.1	69.6	55.8	68.1
1965	58.9	62.4	56.5	59.0	64.8	58.6	56.9	71.2	61.4	76.5	82.2	85.1	66.1
1964	61.1	64.0	58.9	61.8	70.2	65.2	59.0	54.4	65.0	60.0	63.3	66.4	62.4
Average 1950-1973	66.6	64.7	61.9	62.1	64.9	64.5	60.4	61.8	66.4	67.4	67.1	65.2	64.4

TABLE 3
EVAPORATION AT FALCON DAM
(Data From the International Boundary and Water Commission Water Bulletins 34-43)
Inches Evaporated From 4-Foot Pan

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	*Average 1956 1973
January	4.82	5.20	2.63	4.88	2.84	3.96	2.63	5.96	4.20	4.01	4.09
February	5.26	5.40	3.59	5.86	3.70	4.00	4.60	7.32	5.06	3.66	5.26
March	8.80	7.60	6.74	9.52	6.72	8.20	8.01	11.20	7.68	7.63	8.50
April	10.60	10.00	9.86	13.88	7.49	9.69	10.42	13.00	11.30	7.80	10.60
May	11.75	11.95	8.98	13.84	9.78	11.75	10.66	13.08	8.36	11.16	12.22
June	12.62	16.15	10.52	15.96	12.47	12.99	13.23	15.49	9.41	11.89	13.54
July	16.08	18.23	14.21	19.25	11.49	17.36	13.65	15.72	10.78	12.85	15.86
August	18.52	14.90	14.05	13.39	13.22	13.30	13.40	10.30	13.02	10.60	14.38
September	11.71	13.12	10.34	7.45	7.27	8.93	10.45	9.41	10.34	9.16	10.18
October	7.67	6.90	7.76	6.20	6.50	8.08	6.63	6.01	6.72	6.30	7.54
November	5.91	4.85	7.40	2.97	5.25	5.28	6.47	5.49	4.26	4.85	5.43
December	3.80	2.99	5.68	2.97	4.76	3.65	5.13	3.59	3.72	5.08	4.07
Total for Year	117.54	117.29	101.76	116.17	91.49	107.19	105.28	116.57	94.85	94.99	111.67

*Some Months Missing.

TABLE 4

RAINFALL IN INCHES AT FALCON DAM AND ROMA (INTERNATIONAL BRIDGE)

(DATA FROM INTERNATIONAL BOUNDARY AND WATER COMMISSION WATER BULLETINS 34-43)

F = Falcon R = Roma

		Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
1973	F	1.11	4.14	0.00	.50	1.79	7.36	.56	5.80	12.17	3.13	.29	.17	37.02
	R	.87	4.33	0.00	.52	2.58	5.30	2.62	.95	7.65	2.28	0.00	0.00	27.10
1972	F	.14	.91	.45	2.25	3.80	6.12	1.55	.32	5.61	.33	1.63	.22	23.33
	R	T	.80	0.00	2.50	.31	4.58	3.00	0.00	9.10	0.00	1.90	0.00	22.19
1971	F	0.00	0.00	0.00	.38	.05	2.16	1.82	4.27	11.77	3.86	.03	.37	24.71
	R	0.00	0.00	0.00	.47	0.00	1.87	1.07	3.27	10.50	0.00	0.00	0.00	17.18
1970	F	1.98	1.47	.04	.49	2.51	3.09	1.29	.69	5.87	1.16	0.00	.17	18.76
	R	1.48	1.73	0.00	0.00	.45	4.40	1.03	0.00	3.92	2.00	0.00	0.00	15.01
1969	F	.24	1.05	.12	.59	2.84	3.49	1.64	2.86	1.01	1.21	2.76	.63	18.44
	R	0.00	.79	0.00	.50	1.55	2.50	0.00	2.87	1.66	.56	2.56	.53	13.52
1968	F	.98	1.59	.45	1.87	.54	2.60	1.94	1.88	6.09	1.69	.34	.41	20.38
	R	1.00	1.00	1.40	3.51	0.00	2.80	.86	1.32	2.29	1.53	0.00	0.00	15.71
1967	F	1.00	.39	.54	1.70	.48	.48	.20	8.87	21.60	.94	3.35	.74	40.30
	R	1.16	1.08	0.00	1.92	.54	.70	.80	8.52	24.71	.28	2.03	0.00	41.74
1966	F	2.06	1.70	.31	2.63	7.97	4.68	.61	7.66	.50	.50	0.00	0.00	28.63
	R	2.10	2.04	0.00	3.71	7.73	3.08	0.00	1.45	0.00	1.75	0.00	0.00	21.86
1965	F	.19	.79	1.83	.51	2.65	.13	.05	1.02	1.45	1.13	.66	2.99	13.40
	R	0.00	1.28	1.55	.45	1.17	1.40	0.00	1.08	5.58	1.40	1.66	3.15	18.72
1964	F	1.07	1.04	.21	.56	6.71	1.52	.96	.07	7.28	1.56	.92	.74	22.64
	R	.70	1.05	.10	.87	8.80	0.00	1.65	.76	3.14	.80	1.34	.30	19.51
Average 1950-1973	F	.82	.97	.63	1.19	2.36	2.85	.84	2.62	4.80	2.24	1.16	.61	21.09
1941-1973	R	.86	1.10	.69	1.37	1.81	2.23	.89	2.12	4.63	2.07	.80	.47	19.04

T = Trace

TABLE 5

DISCHARGE OF THE RIO GRANDE AT ROMA

(Data from International Boundary and Water Commission Summary Water Bulletin No. 1, p. 41-42)

Monthly Discharge in Acre-Feet

Month	1900	1901	1902	1903	1904	1905	1906	1907	1908
Jan.		201,000	137,000	167,000	136,000	277,000	367,000	343,000	326,000
Feb.		155,000	116,000	158,000	115,000	191,000	352,000	272,000	191,000
Mar.		155,000	102,000	u 161,000	107,000	474,000	277,000	222,000	163,000
Apr.		122,000	159,000	* 102,000	152,000	462,000	168,000	198,000	460,000
May		360,000	310,000	362,000	290,000	630,000	368,000	406,000	373,000
June		263,000	101,000	1,090,000	417,000	1,030,000	449,000	515,000	200,000
July		141,000	348,000	729,000	251,000	1,240,000	1,300,000	695,000	270,000
Aug.		284,000	466,000	434,000	122,000	1,000,000	1,760,000	322,000	863,000
Sept.	907,000	370,000	800,000	465,000	2,420,000	903,000	1,230,000	703,000	742,000
Oct.	766,000	282,000	422,000	398,000	1,500,000	739,000	624,000	495,000	265,000
Nov.	346,000	293,000	177,000	163,000	708,000	461,000	495,000	613,000	151,000
Dec.	279,000	171,000	246,000	143,000	457,000	557,000	630,000	621,000	135,000
Total		2,797,000	3,364,000	*4,372,000	6,675,000	7,964,000	8,020,000	5,405,000	4,139,000

Month	1909	1910	1911	1912	1913	* 1924	* 1925	* 1926	* 1927
Jan.	151,000	256,000	103,000	169,000	145,000	466,000	237,000	254,000	225,000
Feb.	123,000	150,000	129,000	130,000	149,000	275,000	184,000	208,000	226,000
Mar.	137,000	155,000	143,000	101,000	206,000	246,000	201,000	201,000	198,000
Apr.	119,000	258,000	184,000	168,000	125,000	197,000	180,000	400,000	194,000
May	216,000	391,000	390,000	212,000	291,000	254,000	524,000	398,000	179,000
June	327,000	265,000	390,000	1,060,000	400,000	277,000	837,000	318,000	511,000
July	1,370,000	248,000	541,000	279,000	222,000	185,000	424,000	307,000	379,000
Aug.	1,140,000	84,800	439,000	345,000	149,000	158,000	600,000	480,000	212,000
Sept.	1,020,000	1,140,000	394,000	825,000	540,000	1,020,000	1,702,000	520,000	240,000
Oct.	270,000	341,000	705,000	462,000	770,000	540,000	800,000	570,000	451,000
Nov.	168,000	133,000	359,000	162,000	243,000	308,000	351,000	280,000	189,000
Dec.	170,000	118,000	204,000	178,000	267,000	274,000	261,000	262,000	191,000
Total	5,211,000	3,539,800	3,981,000	4,091,000	3,507,000	4,200,000	6,301,000	4,198,000	3,195,000

Month	* 1928	1929	1930	1931	1932	1933	1934	1935	1936
Jan.	209,000	* 207,000	146,000	208,000	166,910	467,370	219,000	119,000	190,000
Feb.	180,000	* 163,000	138,000	220,000	152,330	349,000	177,000	108,000	159,000
Mar.	181,000	* 186,000	99,000	201,000	155,070	260,610	174,000	126,000	188,000
Apr.	150,000	185,000	225,000	160,000	133,470	223,560	239,000	164,000	144,000
May	683,000	326,000	406,000	473,000	233,460	195,530	219,000	570,000	434,000
June	232,000	184,000	595,000	290,000	112,700	178,240	253,000	1,586,000	202,000
July	150,000	240,000	131,000	542,530	195,410	265,390	189,000	400,000	515,000
Aug.	400,000	276,000	246,000	285,110	228,080	242,620	157,000	* 248,000	220,000
Sept.	809,000	338,000	117,000	152,750	3,047,630	1,266,270	196,000	*1,499,000	958,000
Oct.	359,000	252,000	732,000	180,820	2,371,870	673,950	163,000	471,000	536,000
Nov.	283,000	171,000	336,000	151,820	735,960	253,890	127,000	* 252,000	194,000
Dec.	259,000	192,000	213,000	192,580	565,140	207,590	114,000	231,000	200,000
Total	3,895,000	2,720,000	3,382,000	3,077,610	8,098,030	4,584,020	2,227,000	5,774,000	3,940,000

Month	1937	1938	1939	1940	1941	1942	1943	1944	1945
Jan.	175,000	209,000	* 170,000	133,800	147,600	262,800	226,200	165,600	169,800
Feb.	147,000	148,000	147,000	125,100	141,100	203,000	168,000	136,400	144,000
Mar.	155,000	160,000	132,000	325,600	123,900	197,900	165,400	140,500	139,800
Apr.	104,000	147,000	125,500	145,900	141,500	175,500	135,500	91,400	259,200
May	133,000	167,000	454,000	317,900	706,300	487,900	239,100	299,000	91,320
June	361,000	92,600	193,000	426,400	609,000	389,500	324,900	184,200	53,990
July	144,000	1,217,000	136,000	260,000	410,700	668,600	371,200	94,100	447,000
Aug.	162,000	743,000	402,000	347,600	450,200	490,900	142,900	873,800	109,400
Sept.	217,000	1,083,000	199,000	326,900	878,700	1,690,000	244,500	993,500	69,900
Oct.	344,000	504,000	289,000	379,400	1,639,300	728,800	337,100	399,200	827,900
Nov.	138,000	190,000	153,000	138,600	592,900	338,700	171,300	186,500	172,200
Dec.	164,000	178,000	139,000	125,100	314,200	244,000	179,700	164,900	137,700
Total	2,244,000	4,836,600	2,539,500	3,052,300	6,155,400	5,877,600	2,705,800	3,729,100	2,622,210

Month	1946	1947	1948	1949	1950	1951	1952	1953	1954
Jan.	144,500	175,100	103,600	120,000	169,600	93,660	63,170	50,170	196,400
Feb.	118,600	149,900	107,000	402,000	136,900	82,570	48,690	33,730	295,500
Mar.	105,700	129,000	117,100	251,000	128,400	105,700	43,160	69,760	271,100
Apr.	180,700	83,710	64,250	855,700	108,100	74,610	41,870	53,780	141,600
May	535,400	257,300	108,900	388,400	279,800	321,700	180,500	48,340	303,500
June	435,300	377,900	686,800	353,000	256,400	295,500	116,800	109	346,900
July	213,300	101,900	608,000	240,700	243,000	54,020	333,200	12,500	95,370
Aug.	171,800	437,700	140,500	566,600	195,700	75,640	53,280	292,800	144,400
Sept.	407,100	410,000	823,900	387,400	279,400	457,000	40,800	261,400	104,200
Oct.	618,700	137,700	271,800	347,600	222,700	144,000	24,040	189,000	46,570
Nov.	173,200	129,200	154,000	211,200	105,100	78,860	35,340	76,520	68,590
Dec.	151,600	131,400	128,200	188,600	101,900	66,120	43,200	77,350	106,200
Total	3,255,900	2,570,810	3,314,050	4,312,200	2,227,000	1,849,380	1,024,050	1,165,459	2,123,330

* Estimated * Partly estimated

Water was initially impounded upstream in:

La Boquilla Reservoir 1914
Elephant Butte Reservoir 1915
Caballo Reservoir ..... Feb. 1938
Madero Reservoir ..... July 1948

TABLE 6

1955-1973 DISCHARGE FROM FALCON DAM

(DATA FROM INTERNATIONAL BOUNDARY AND WATER COMMISSION WATER BULLETINS 25-43)

MONTHLY DISCHARGE IN ACRE-FEET

LUIS LEON RESERVOIR AND AMISTAD RESERVOIR BEGAN TO RETAIN WATER IN 1968

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
1955*	185,440	123,470	82,690	174,980	265,030	220,460	39,695	98,100	7,881	43,560	55,578	93,764	1,390,648
1956*	174,060	175,950	84,320	76,851	119,362	139,002.6	9,241	13,062	40,785.2	13,641.9	15,172.4	94,977	9,564,257
1967*	163,000	42,600	2,640	24,600	217,000	165,000	111,000	206,000	151,000	198,000	77,500	130,000	1,488,340
1958	46,100	16,600	22,600	226,000	260,000	408,000	79,500	133,000	235,000	1,997,000	1,128,000	465,000	5,016,800
1959	21,500	15,400	41,300	84,800	163,000	140,000	178,000	86,200	136,000	74,800	44,300	84,500	1,069,800
1960	179,030	122,880	33,542	69,467	123,066	277,810	97,000	40,638	18,955	45,845	21,033	18,683	1,047,949
1961	36,641	44,561	168,540	125,346	236,530	107,105	69,100	95,153	99,470	46,785	25,922	62,612	1,351,065
1962	141,640	185,220	32,205	112,011	219,460	185,327	37,104	34,957	18,355	44,814	25,159	31,717	1,067,969
1963	67,165	102,392	80,580	210,340	29,485	133,820	33,359	61,578	19,202	31,048	14,435	22,923	806,327
1964	29,786	21,431	48,073	143,386	143,182	60,457	45,999	39,889	24,491	68,910	51,588	56,552	733,744
1965	208,080	70,878	58,580	203,890	181,453	146,360	115,870	42,137	71,747	22,582	25,531	21,332	1,168,440
1966	27,949	21,977	25,098	47,961	24,580	89,325	81,041	102,766	339,914	39,513	48,055	50,134	898,313
1967	74,419	71,427	75,598	232,690	156,700	91,140	70,790	76,316	720	153,274	4,727	31,151	1,038,952
1968	57,910	36,716	34,438	48,096	165,910	104,837	25,836	74,739	31,527	32,365	29,478	29,645	671,317
1969	202,690	109,016	52,450	103,630	162,760	181,300	81,896	56,978	17,606	38,217	31,618	16,420	1,054,581
1970	8,190	13,504	31,248	118,602	168,800	34,517	29,886	61,142	15,269	15,665	25,370	54,468	576,661
1971	208,790	65,150	83,450	123,185	191,290	61,489	10,564	30,342	544,939	570,800	143,594	83,912	2,117,505
1972	145,210	59,792	28,897	212,910	10,877	11,539	6,473	31,267	94,848	67,666	27,012	21,848	718,339
1973	10,397	14,306	19,680	146,300	220,984	117,153	10,360	83,229	114,192	146,964	706	4,417	888,688

*Recorded at Chapeno, Texas, 2.5 miles below Falcon Dam.

TABLE 7

Bedrock Stratigraphic Units in the Vicinity of the Rio Grande – Falcon Thorn Woodlands Area.
(Data from Maxwell, 1970, p. 87-91 and Sellards and others, 1932, p. 651-689.)

EOCENE			
Claiborne Group			Jackson Group
Sparta Sandstone	Crockett Formation (Cook Mountain Formation)	Yegua Formation	Whitsett Formation Manning Formation Welborn Formation Caddell Formation
Exposed in Study Area			

Poorly consolidated sandstone, sandy shale, and clay; sand usually gray or buff, occasionally weathering to reddish hues, clays usually gray or chocolate-colored and contain considerable carbonaceous material.

Firmly cemented sandstone with some clay, fossiliferous limestone, and limestone concretions; of marine origin, *many beds contain abundant fossils*; typically forms rolling sandstone hills with red sandy soils.

Slightly fossiliferous marine clay with some weakly resistant lignitic sandstone; clays typically dark chocholate-brown to gray and greenish-gray; typically forms rolling open prairie with dark soils.

Sandstone and clay; sandstone variable in color, texture, and composition, commonly with intricate cross bedding; varicolored clays occasionally contain thin beds of white volcanic ash; land plants, leaves, lignite, and marine fossils indicate both near-shore and continental (both marine and non-marine) deposition.

A VEGETATIONAL SURVEY OF THE FALCON DAM AREA

Mary Butterwick and Stuart Strong

INTRODUCTION

Situated within the erosional valley of the Rio Grande, Starr County is characterized by a gently rolling topography that is dissected by numerous arroyos that converge with the river. Higher land which is away from the river is locally referred to as the "mesa" and supports a dense growth of xerophytic thorny shrubs such as blackbrush acacia (*Acacia rigidula*), guajillo (*Acacia berlandieri*), huisache (*Acacia smallii*), lotebush (*Ziziphus obtusifolia*), brazil (*Condalia hookeri*), coyotillo (*Karwinskia humboldtiana),* cenizo (*Leucophyllum frutescens*) and guayacan (*Porlieria angustifolia*). Trees growing within the flood plains of the Rio Grande attain a considerable height. The higher alluvial terraces are predominantly inhabited by mesquite (*Prosopis glandulosa*) and spiny hackberry (*Celtis pallida*) with scattered individuals of Texas sugarberry (*Celtis laevigata*), lime-pricklyash (*Zanthoxylum fagara*), and snake-eye (*Phaulothamnus spinescens*). Along the sandy banks of the river are found black willow (*Salix nigra*), Mexican ash (*Fraxinus berlandieriana*), huisache, buttonbush (*Cephalanthus occidentalis*), horse-weed (*Conyza canadensis*), retama (*Parkinsonia aculeata*), and *Heimia salicifolia.* Common herbs include flat sedge (*Cyperus rotundus*), moco de guajolote (*Persicaria vulgaris*), portulaca (*Portalaca mundula*) along with grasses such as Dallis grass (*Paspalum dilatatum*), Florida paspalum (*Paspalum floridanum*), cupgrass (*Eriochloa contracta*), and cockspur (*Echinochloa colonum*).

One of the interesting features of the South Texas Plains vegetation zone is that it constitutes an overlap of western desert, northern, and tropical floras. Plants such as mesquite, leatherstem (*Jatropha dioica*), lotebush, and brazil are common elements in the Trans-Pecos region. Sugar hackberry and Texas persimmon (*Diospyros texana*) frequently occur farther north in Texas. *Lantana horrida*, heartseed (*Cardiospermum dissectum*), anacahuite (*Cordia boissieri*), and Texas ebony are more tropical in distribution. The Rio Grande region delineates the northernmost extension of the range of Montezuma bald cypress (*Taxodium mucranatum*), Gregg wildbuckwheat (*Eriogonum greggii*), heartseed, Texas ebony, and anacahuite.

The vegetation of this area typically flowers in response to intermittent rainfall. As collectors, we were fortunate to be working in the field shortly after a substantial rain, and thus several species including Texas ebony, cenizo, *Amoreuxia wrightii,* anacahuite, and various cacti, were flowering.

METHODS

The plants of the study area were surveyed by two methods. First, the qualitative nature of the flora was determined by a collection of plant specimens throughout the area. Identifications of the species were made according to the *Manual of the Vascular Plants of Texas* (Correll and Johnston 1970) and the *Manual of the Grasses of the United States* (Hitchcock 1950). Specimens collected have been stored at the University of Texas Herbarium for future reference.

Secondly, the composition of the vegetation was measured quantitatively. Three areas were chosen to be a representative sample of the different environmental forms present: river bank, upper river terraces, and gravelly uplands. In all of the sample areas, the line transect method was used according to the procedure described by Curtis and Cottam (1963). A record was made of the number of individual plants of each species and the area along a 100-m tape covered by each individual. From this data it was possible to calculate relative density, relative dominance, and raw coverage of the species encountered (Appendix 2).

DISCUSSION

The vegetation of the Rio Grande Valley has attracted the attention of botanists since the early part of the 19th century. Dr. Louis Berlandier, considered to be the earliest botanist in southern Texas, served as naturalist of the Mier Teran Expedition whose task was to characterize the country along the proposed U.S.-Mexico boundary in 1828. William A. McClintock (1930) traveled through Starr County enroute to Monterrey during the Mexican War and observed that "there is nothing of the vegetable world on the Rio Grande, but what is armed with weapons

of defense and offense." Charles Wright, in conjunction with the U.S.-Mexican Boundary Survey, extensively collected along the Rio Grande in 1851. Valery Havard (1885) noted in his report on the flora of western and southern Texas that near Rio Grande City the "woody vegetation on neighboring bluffs and throughout the river belt, . . ., is dense and in low places reaches the magnitude of low timber." Another valuable reference is Charles W. Winkler's (1915) complete account of early botanical investigations in Texas. A more recent treatment of the Rio Grande Valley was written by Elzada U. Clover (1937) based on field study carried out over a two year period. Her work included a phytographic study in addition to geological and topographical notes.

The climate of this study area is fairly mild with mean annual temperature of 23°C. Mean length of the warm season, that is the period in which temperature remains above 0°C, ranges from 290 to 305 days. Killing frosts are a rare occurrence. Although the mean annual precipitation is 4.6 cm, rainfall is irregular and charactized by violent thunderstorms. Droughts are known to this area. Evaporation rates are relatively high, ranging from about 150 to 180 cm a year.

Notwithstanding a rather intricate drainage system, surface water is scarce, for the arroyos contain water only immediately after a substantial shower. This feature, in addition to the warm-dry climate, results in a close correlation between vegetation types and topographic factors. Three main plant associations have been delineated: sauzal-fresnal association along the banks of the Rio Grande; mesquital-granjenal association on the high alluvial terraces, and chaparral association occurring throughout the mesa area. Local nomenclature has been used to describe vegetation types in accordance with Bartlett (1935) and Lundell (1934).

SAUZAL-FRESNAL ASSOCIATION

The silty banks of the Rio Grande, often subject to excessive quantities of water, favor aggregations of such hydrophilic species as black willow, Mexican ash, Texas sugarberry, buttonbush, horse-weed, and seep willow. Huisache, retama, *Heimia salicifolia* and white mulberry (*Morus alba*) also frequent this area (Tables 1 and 2; Fig. 1). On these lower terraces that are periodically submerged the sedges are well represented by *Cyperus rotundus, Cyperus ochraceus,* dwarf spikesedge, (*Eleocharis parvula*) and California bullrush (*Scirpus californicus*), as are numerous other herbaceous species including brookweed (*Samolus cuneatus*), yerbo del tajo (*Eclipta alba*), catch-fly gentian (*Eustoma exaltatum*), moco de guajolote, and spreading dayflower (*Commelina diffusa*). The moist environment nurtures the growth of a variety of grasses, the largest being carizzo (*Arundo donax*). Bermuda grass (*Cynodon dactylon*) and gummy lovegrass (*Eragrostis curtipedicellata*) carpet many of the more extensive terraces. African jointtail (*Manisuris altissima*), Florida paspalum, cockspur, cupgrass, knotroot bristlegrass (*Setaria geniculata*), four-flower trichloris (*Trichloris pluriflora*), and crowfootgrass (*Dactyloctenium aegyptium*) are commonly found in this association.

MESQUITAL-GRANJENAL ASSOCIATION

Stretches of the Rio Grande from Falcon Dam southwards toward Roma are characterized by a rather extensive flood plain. It is on the upper terraces to which the mesquital-granjenal association is restricted. The soil is predominantly a sandy silt of alluvial origin. The slightly raised terrain protects this area from periodic fluctuations in the river level and thus probably is rarely inundated by water. Here a luxuriant understory comprised of *Ruellia nudiflora,* pigeon-berry (*Rivina humilis*), fiddleleaf tobacco (*Nicotiana repanda*), and *Calyptocarpus vialis* is featured. Dallis grass, Bermuda grass, bristlegrass (*Setaria leucotricha*), and pink pappusgrass (*Pappophorum bicolor*) are common grasses in this association.

Access to an ample water supply allows the growth and development of substantial trees. Mesquite and spiny hackberry along with huisache, Roemer acacia (*Acacia roemeriana*), retama, and Texas sugarberry form a narrow band of dense woods. Two representative sites sampled showed a ground coverage of about 92% and 95% (Tables 3 and 4; Fig. 2). Minor shrubs such as lime pricklyash, *Heimia salicifolia,* snake-eye, and spiny bumelia (*Bumelia rigida*) are infrequently encountered. Thickets of Lindheimer prickly-pear (*Opuntia lindheimeri*) have invaded several areas that have been cleared or otherwise disturbed.

CHAPARRAL ASSOCIATION

Chaparral, as used in this study, applies to the semidesert brush composed of stiff or thorny, mostly small-leaved shrubs. Extending throughout the upland mesa in undisturbed areas, this association is the most widespread. McClintock (1930) described the Rio Grande chaparral as comprised of "thousands of shrubs and grasses, all leaving pricks, thorns or burs." Surely the tremendous diversity of species present is one of the striking features of this association. Additional variation is seen in the abundance and composi-

tion of vegetation from one site to another. Line transects showed blackbrush acacias and guajillo to be the dominant shrubs (Tables 5 and 6; Fig. 3). Minor shrub components included guayacan, coyatillo, lotebush, littleleaf fiddleweed (*Citharexylum brachyanthum*), common lantana (*Lantana horrida*), and brazil. Mesquite was also present but displayed a stunted and shrubby growth form. *Thryallis angustifolia,* a rather low shrub, frequented this area with racemes of showy flowers that ranged from yellow to red with age.

The sandy-gravel soil allows for excellent drainage and thus nurtures the development of numerous cacti. Tasajillo (*Opuntia leptocaulis*) and Lindheimer prickly pear accounted for a significant percentage of the ground cover (Tables 5 and 6). Pitaya (*Echinocereus enneacanthus*), lace echinocerus (*Echinocereus reichenbachii*), *Coryphantha macromeris,* hedgehog cactus (*Ferocactus setispinus*), and *Mammillaria gummifera* were scattered throughout this general area. As a result of previous rains, several of these species were found in flower.

No well-developed grassland was observed within the chaparral association. Although a variety of species were represented, they were thinly dispersed beneath the shrub layer and made up a rather insignificant percentage of the vegetation. Grasses frequently encountered included slim tridens (*Tridens muticus*), white tridens (*Tridens albescens*), purple three-awn (*Aristida purpurea*), *Erioneuron pilosum,* common curlymesquite (*Hilaria belangeri*), red grama (*Bouteloua trifida*), dropseed (*Sporobolus pyrimidatus*), and *Panicum ramisetum.*

The abundance of glandleaf milkwort (*Polygala macradenia*) and heartleaf hibiscus (*Hibiscus cardiophyllus*) often resulted in a colorful herbaceous understory.

Another series of line transects on top of a sandstone bluff showed cenizo to be the dominant shrub, followed by Texas ebony and hierba dulce (*Lippia graveolens*) (Tables 7, 8, and 9; Fig. 4). In addition to several of the shrubs mentioned from the other transect, shorthorn zexmenia (*Zexmenia brevifolia*), Texas kidneywood (*Eysenhardtia texana*), veinyleaf lantana (*Lantana macropoda*), allthorn goatbush (*Castela texana*), manystem ratany (*Krameria ramosissima*), shrubby blue salvia (*Salvia ballotaeflora*), capul (*Schaefferia cuneifolia*), and wolfberry (*Lycium berlandieri*) were common elements of this sample area.

Although dense, local thickets are formed, data from transects within the chaparral shows the percentage ground cover to range from about 53% (Table 8) to about 67% (Table 7), indicating relatively sparse vegetation.

The arroyos situated within this study area are too minor to warrant designation as a distinct association. Vegetation is basically a continuation of the zauzal-fresno association with occasional chaparral elements establishing themselves (Fig. 5). Perhaps the most characteristic feature of the arroyos is its instability. With each torrent of rain comes another step in the erosion process that washes material downstream and alters the course of the drainages. As a result, plants such as rattle-pod (*Sesbania drummondii*), willow bacchais (*Baccharis salicina*), mesquite, black willow, huisache, and retama, that can withstand sporadic floods, are the dominant species. Slightly elevated banks support a grass cover composed of Bermuda grass and Dallis grass with scattered individuals of crowfoot grass, dropseed, tridens, cockspur, bristle grass, burgrass (*Tragus berteronianus*), and bluestem (*Bothriochloa saccharoides*). Numerous rather weedy herbaceous species including sunflower (*Helianthus annuus*), crownbeard (*Verbesina encelioides*), salt heliotrope (*Heliotropium curassavicum*), and careless weed (*Amaranthus palmeri*) occupy the more protected banks.

The three associations discussed apply only to undisturbed areas. Significant portions of the region have felt the impact of human activity through cultivation, quarrying, and clearing. A typical cleared area has a thick cover of buffel grass (*Cenchrus ciliaris*), an introduced grass from India, that prohibits the growth of other herbaceous species (Fig. 6). The mesquite present is either left during the clearing process or represents secondary growth. At a few isolated sites where the buffel grass does not dominate, an interesting assemblage of herbs such as *Polianthes variegata, Amoreuxia wrightii,* bundle-flower (*Desmanthus virgatus*), bearded dalea (*Dalea pogonathera*), and rushpea (*Hoffmanseggia glauca*) are able to become established.

RARE PLANTS

Situated along the northern boundary of tropical floras, the Rio Grande Valley features species found nowhere else in the country. For instance, Montezuma Bald Cypress, the famous tree of Santa Maria del Tule, Oaxaca, extends as far north as the Rio Grande. A population of cypress consisting of 13 individuals is known just upstream from Salineno. Another specimen was sighted about 2 km south of Santa Margarita (Fig. 7). Emory (1857) reported a cypress near the mouth of the Rio Salado, a tributary of the Rio Grande. Clover (1937) found another single individual in the woods south of Havana in Hidalgo County.

Montezuma Bald Cypress is distinquished by its

evergreen habit as opposed to the more northern Bald Cypress (*Taxodium distichum*) which sheds its leaves in preparation for winter dormancy. The largest cypress in the Salineno population had a trunk measuring 4.39 m at chest height. No precise means of dating the trees was available. However, the cypress cited by Clover was about 12 m tall and was reported by Mexican residents to have been there at least a hundred years. Since these trees are of a comparable height, it is probable that they are over a century old. Although female cones were abundant, no evidence of seedling establishment was observed. Constant fluctuation in the river level may be an inhibiting factor.

A rather extensive population of Gregg wild buckwheat (*Eriogonum greggii*) was found south of Santa Margarita on sandy soil interspersed with gypsum. This species was previously known in Texas only from La Joya in Hidalgo County, based on a collection by Mrs. E. J. Walker in 1942.

Slashleaf heartseed (*Cardiospermum dissectum*) was located in dense brush about 1 km south of Santa Margarita. A slender climbing vine with much dissected leaves, this species is considered very rare in Texas and is known from another population in Starr County. Its range extends into Tamaulipas and Chihuahua.

Amoreuxia wrightii features showy orange petals with red striations and five-parted leaves that are reminiscent of jicamilla (*Jatropha cathartica*). Considered rare in Texas, it has been collected in Starr, La Salle, Kleberg, Cameron, and Hidalgo counties. *Amoreuxia* was scattered throughout the uplands of the study area.

CONCLUSION

Alterations within the Rio Grande Plains have been considerable in the past few decades. An increasing portion of the once expansive chaparral that so impressed the early investigators is being cleared to allow for quarrying, grazing, and cultivation. However, undisturbed areas feature a high diversity of plant life that is characteristic of this vegetation zone. The uniqueness of these untouched areas is exemplified by the presence of such rare species as *Taxodium mucronatum, Eriogonum greggi, Amoreuxia wrightii,* and *Cardiospermum dissectum.* The continued success of these rare plant populations depends upon a careful preservation of the yet unaltered mesas and river banks.

LITERATURE CITED

Arbingast, S. A. et. al. 1973. *Atlas of Texas.* University of Texas at Austin. Bureau of Business Research, pp. 15-19.

Bartlett, H. H. 1935. A method of procedure for field work in tropical American phytogeography based upon a botanical reconnaissance in parts of British Honduras and the Peten forest of Guatemala. *Carnegie Inst. Washington, Publ.* No. 461:1-25.

Berlandier, L. 1857. Espedicion scientifica del general Teran a Tejas. *Boletin de la Sociedad Mexicana de Geografia y Estadistica* 5:125-133.

Clover, E. U. 1937. Vegetational Survey of the Lower Rio Grande Valley, Texas. *Madrono* 4:41-100.

Correll, D. S. and Johnston, M. C. 1970. *Manual of the Vascular Plants of Texas.* Renner, Texas: Texas Research Foundation.

Curtis, J. T. and Cottam, G. 1965. *Plant Ecology Workbook.* Minneapolis, Minnesota: Burgess. pp. 95-98.

Emory, W. H. 1857. *Report on the United States and Mexican Boundary Survey* 1(1):XVI+258.

Gould, F. W. 1969. *Texas Plants–A Checklist and Ecological Summary.* College Station, Texas: Texas A&M University.

Gray, A. 1850. *Plantae Wrightianae.* Washington, D.C.: Smithsonian Institute.

Havard, V. 1885. Report on the flora of western and southern Texas. *Proc. U.S. Nat. Mus.* 8:449-533.

Hitchcock, A. S., 1950. *Manual of the Grasses of the United States.* Washington, D.C.: U.S. Government Printing Office.

Lundell, C. L. 1934. Preliminary sketch of the phytgeography of the Yucatan Peninsula. *Carnegie Inst. of Washington, Publ.* No. 436.

McClintock, W. A. 1930. Journal of a trip through Texas and Northern Mexico in 1846-47. *S.W. Historical Quarterly* 34(1-3):20-27, 141-158, 231-256.

Winkler, C. H. 1915. The botany of Texas: an account of the botanical investigations in Texas and adjoining territory. *Univ. Texas Bull.* No. 18.

APPENDIX 1

Localities for line transects presented in Tables 1-9.

Table 1—1 km W-SW of Santa Margarita, along bank of Rio Grande (Roma-Los Saenz W 7.5-minute quadrangle map.)
Table 2—Same as that of Table 1.
Table 3—Upper terraces, 1 km W-SW of Santa Margarita (Roma-Los Saenz W 7.5-minute quadrandle map).
Table 4—Same as that of Table 3.
Table 5—South road leading to Santa Margarita, about .4 km SW of gravel pits (Roma-Los Saenz W 7.5-minute quadrangle map).
Table 6—Same as that of Table 5.
Table 7—2 km S of Santa Margarita, top of sandstone bluffs (Roma-Los Saenz W 7.5-minute quadrangle map).
Table 8—Same as that of Table 7.
Table 9—Same as that of Table 7.

APPENDIX II

Explanation of symbols used in Tables

$$\text{RDi} = \text{Relative Density} = \frac{\text{Total individuals of species}}{\text{Total individuals of all species}}$$

TI = Total individuals

$$\text{RC} = \text{Raw Cover} = \frac{\text{Total area covered by species}}{\text{Total area sampled}}$$

$$\text{RDii} = \text{Relative Dominance} = \frac{\text{Area covered by species}}{\text{Area covered by all species}}$$

TABLE I

Line Transect 1

	TI	RDi	RDii	Coverage in Meters	RC
Acacia smallii	7	28.00	29.05	22.50	22.50
Baccharis glutinosa	6	24.00	5.10	3.95	3.95
Celtis laevigata	3	12.00	14.20	11.00	11.00
Fraxinus berlandieriana	5	20.00	35.51	27.50	27.50
Heimia salicifolia	1	4.00	1.29	1.00	1.00
Parkinsonia aculeata	2	8.00	9.68	7.50	7.50
Prosopis glandulosa	1	4.00	5.16	4.00	4.00
	25	100.00%	99.99%	77.45	77.45%

TABLE II

Line Transect 2

	TI	RDi	RDii	Coverage in Meters	RC
Acacia smallii	19	37.25	38.79	51.50	51.50
Celtis laevigata	4	7.84	19.00	38.50	38.50
Celtis pallida	17	33.33	16.76	22.25	22.25
Condalia hookeri	,1	1.96	2.64	3.50	3.50
Fraxinus berlandieriana	5	9.8	5.27	7.00	7.00
Heimia salicifolia	1	1.96	0.38	0.50	0.50
Karwinskia humboldtiana	1	1.96	0.75	1.00	1.00
Parkinsonia aculeata	1	1.96	4.90	6.50	6.50
Prosopus glandulosa	2	3.92	1.51	2.00	2.00
	51	99.98%	100%	132.75	132.75%

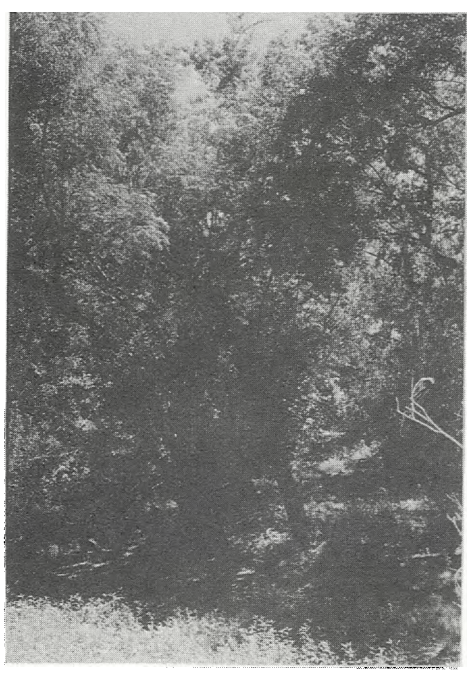


FIGURE 1

The Sauzal-Fresno Association –
site for Line Transects 1 and 2

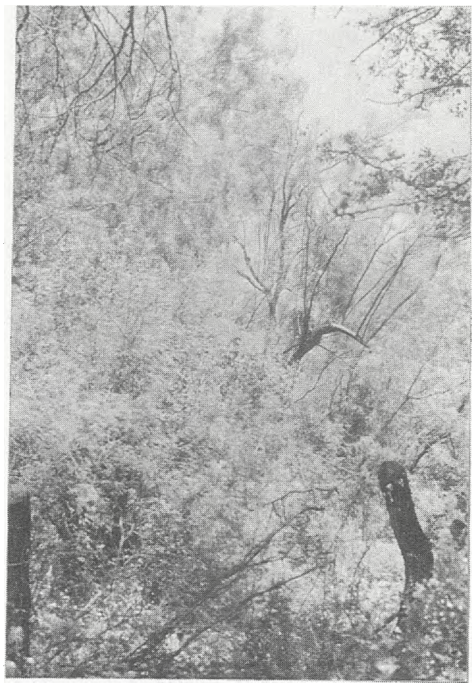


FIGURE 2

The Mesquital-Granjenal Association – site for Line Transects 3 and 4.

TABLE III

Line Transect 3

	TI	RDi	RDii	Coverage in Meters	RC
Acacia smallii	2	5.88	10.78	10.00	10.00
Celtis laevigata	1	2.94	2.69	2.50	2.50
Celtis pallida	6	17.65	3.50	3.25	3.25
Opuntia lindheimeri	2	5.88	2.16	2.00	2.00
Parkinsonia aculeata	1	2.94	2.70	2.50	2.50
Prosopis glandulosa	22	64.70	78.17	72.50	72.50
	34	**99.99%**	**100%**	**92.75**	**92.75%**

TABLE IV

Line Transect 4

	TI	RDi	RDii	Coverage in Meters	RC
Acacia smalii	1	1.96	3.66	3.50	3.50
Celtis laevigata	1	1.96	1.05	1.00	1.00
Celtis pallida	26	50.98	27.75	26.50	26.50
Condalia hookeri	1	1.96	1.05	1.00	1.00
Heimia salicifolia	1	1.96	1.05	1.00	1.00
Opuntia lindheimeri	2	3.92	1.57	1.50	1.50
Prosopis glandulosa	19	37.25	63.87	61.00	61.00
	51	**99.99%**	**100%**	**95.5**	**95.5%**

FIGURE 3

The Chaparral Association – site for Line Transects 5 and 6.

TABLE V

Line Transect 5

	TI	RDi	Coverage in Meters	RC	RDii
Acacia berlandieri	19	19.39	10.10	10.10	17.03
Citharexylon brachyanthum	1	1.02	0.50	0.50	0.84
Karwinskia humboldtiana	1	1.02	0.50	0.50	0.84
Opuntia leptocaulis	22	22.45	9.65	9.65	16.27
Acacia rigidula	37	37.76	28.70	28.70	48.40
Porlieria angustifolia	13	13.27	6.10	6.10	10.29
Prosopis glandulosa	2	2.04	1.75	1.75	3.95
Ziziphus obtusifolia	3	3.06	2.00	2.00	3.37
	98	**100%**	**59.3**	**59.3 %**	**99.99%**

TABLE VI

Line Transect 6

	TI	RDi	Coverage in Meters	RC	RDii
Acacia berlandieri	16	17.78	10.05	10.05	17.69
Celtis pallida	1	1.11	0.50	0.50	0.88
Condalia hookeri	4	4.44	0.80	0.80	1.41
Echinocereus	3	3.33	1.00	1.00	1.76
Karwinskia humboldtiana	2	2.22	1.50	1.50	2.64
Lantana macropoda	1	1.11	0.30	0.30	0.53
Mammillaria scobaria	1	1.11	0.20	0.20	0.35
Mammillaria gummifera var. *applanta*	1	1.11	0.10	0.10	0.17
Opuntia leptacaulis	18	20.00	11.25	11.25	19.80
Opuntia lindheimeri	2	2.22	0.70	0.70	1.23
Acacia rigidula	34	37.78	24.40	24.40	42.96
Porlieria angustifolia	3	3.33	0.90	0.90	1.58
Prosopis glandulosa	1	1.11	2.50	2.50	4.40
Ziziphus obtusifolia	3	3.33	2.60	2.60	4.58
	90	**99.98%**	**56.80**	**56.80%**	**99.98%**

TABLE VII

Line Quadrat 7

	TI	RDi	Coverage in Meters	RC	RDii
Citharexylon brachyanthum	3	2.46	1.30	1.30	1.92
Condalia hookeri	1	0.82	1.00	1.00	1.48
Eysenhardtia texana	7	5.74	4.35	4.35	6.42
Karwinskia humboldtiana	9	7.38	5.85	5.85	8.63
Krameria ramosissima	2	1.64	0.60	0.60	.89
Lantana macropoda	6	4.92	2.92	2.92	4.35
Leucophyllum frutescens	18	14.75	11.75	11.75	17.34
Lippia graveolens	19	15.57	6.15	6.15	9.08
Opuntia leptocaulis	2	1.64	0.80	0.80	1.18
Opuntia lindheimeri	4	3.28	2.00	2.00	2.95
Acacia rigidula	35	28.69	24.65	24.65	36.38
Porlieria angustifolia	4	3.28	1.60	1.60	2.36
Zexmenia brevifolia	10	8.2	3.95	3.95	5.83
Ziziphus obtusifolia	2	1.64	0.80	0.80	1.18
	122	100%	67.72	67.72%	99.99%

FIGURE 4

The Chaparral Association – site for Line Transects 7, 8, and 9.

TABLE VIII

Line Transect 8

	TI	RDi	Coverage in Meters	RC	RDii
Castela texana	1	0.92	0.20	0.20	0.38
Citharexylon brachyanthum	5	4.63	2.65	2.65	5.02
Condalia hookeri	1	0.92	0.20	0.20	0.38
Eysenhardtia texana	3	2.78	1.00	1.00	1.90
Jatropha dioica	4	3.70	0.55	0.55	1.04
Karwinskia humboldtiana	6	5.56	3.75	3.75	7.11
Lantana macropoda	2	1.85	0.30	0.30	0.57
Leucophyllum frutescens	18	16.67	11.90	11.90	22.56
Lippia graveolens	21	19.44	5.95	5.95	11.28
Lycium berlandieri	4	3.70	2.30	2.30	4.36
Opuntia leptocaulis	6	5.56	2.35	2.35	4.45
Opuntia lindheimeri	2	1.85	0.40	0.40	0.76
Acacia rigidula	22	20.37	16.75	16.75	31.75
Porlieria angustifolia	3	2.78	1.00	1.00	1.90
Zexmenia brevifolia	9	8.33	2.70	2.70	5.12
Ziziphus obtusifolia	1	0.92	0.75	0.75	1.42
	108	99.98%	52.75	52.75%	100.00%

TABLE IX

Line Transect 9

	TI	RDi	Coverage in Meters	RC	RDii
Cercidium texanum	3	3.03	3.25	3.25	5.20
Citharexylon brachyanthum	2	2.02	1.60	1.60	2.56
Condalia hookeri	2	2.02	1.80	1.80	2.88
Croton	2	2.02	0.40	0.40	0.64
Eysenhardtia texana	7	7.07	5.20	5.20	8.32
Forestiera angustifolia	4	4.04	2.60	2.60	4.16
Jatropha dioica	3	3.03	0.50	0.50	0.80
Karwinskia humboldtiana	8	8.08	4.65	4.65	7.44
Krumeria ramosisima	1	1.01	0.30	0.30	0.48
Leucophyllum frutescens	23	23.23	15.00	15.00	24.00
Lippia graveolens	4	4.04	1.80	1.80	2.88
Lycium berlandieri	3	3.03	1.35	1.35	2.16
Opuntia leptocaulis	7	7.07	4.60	4.60	7.36
Opuntia lindheimeri	3	3.03	2.20	2.20	3.52
Acacia rigidula	17	17.17	12.65	12.65	20.24
Porlieria angustifolia	4	4.04	2.05	2.05	3.28
Salvia ballotaefolia	1	1.01	0.50	0.50	0.80
Schaefferia cuneifolia	1	1.01	0.40	0.40	0.64
Zexmenia brevifolia	3	3.03	1.15	1.15	1.84
Ziziphus obtusifolia	1	1.01	0.50	0.50	0.80
	99	99.99%	62.50	62.50%	100.00%

FIGURE 5

Dense arroyo vegetation made up of rattlepod, willow baccharis and mesquite.

FIGURE 6

Representative view of a cleared area.

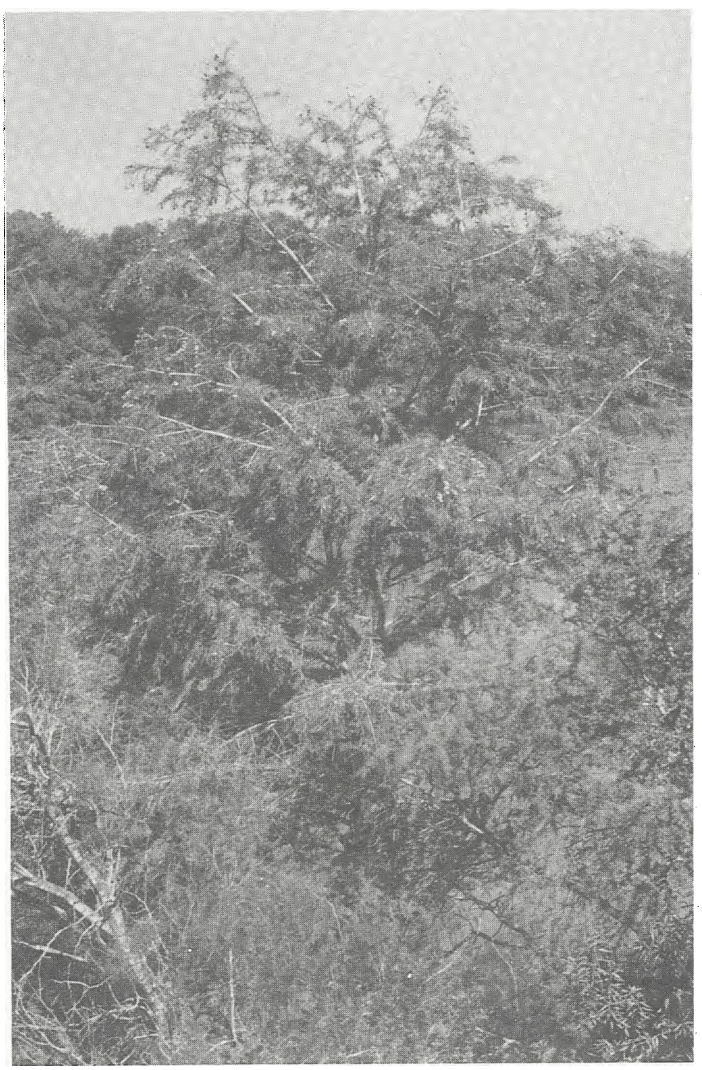


FIGURE 7

An individual of Montezuma Bald Cypress along the banks of the Rio Grande River.

FALCON DAM SPECIES LIST

A – ANNUAL
P – PERENNIAL
N – NATIVE
I – INTRODUCED
* – ENDEMIC TO TEXAS

SCIENTIFIC NAME		COMMON NAME
MARSILEACEAE		PEPPERWORT FAMILY
Marsilea mucronata A. Br.	NP	Hairy Pepperwort
Marsilea uncinata A. Br.	NP	Water Pepper
TAXODIACEAE		TAXODIUM FAMILY
Taxodium mucronatum Ten.	NP	Montezuma Bald Cypress, Ahuehuette
EPHEDRACEAE		EPHEDRA FAMILY
Ephedra antisyphilitica C.A. Mey	NP	Clapweed, Popote
POACEAE		GRASS FAMILY
Aristida longiseta Steud.	NP	Red Three-awn
Aristida purpurea Nutt.	NP	Purple Three-awn
Aristida wrightii Nash	NP	Wright Three-awn
Arondo donax L.	IP	Giant Reed, Carrizo
Bothriochloa saccharoides (Sw.) Rydb.	NP	Silver Beargrass, Silver Bluestem
Bouteloua aristidoides (H.B.K.) Griesb.	NA	Needle Grama
Bouteloua trifida Thurb.	NP	Red Grama
Buchloe dactyloides (Nutt.) Engelm.	NP	Buffalograss
Cenchrus ciliaris L.	IP	Buffelgrass
Cenchrus incertus M.A. Curtis	NP	Grassbur, Coast Sandbur
Chloris sp.		
Cynodon dactylon (L.) Pers.	IP	Bermuda Grass, Rata de Gallo
Dactyloctenium aegyptium (L.) Beauv.	NA	Crowfoot
Dichanthium annualatum Stapf.	NA	Kleberg Bluestem
Echinochloa colonum (L.) Link.	NA	Jungle-Rice
Eleocharis macrostachya Britt.	NP	
Eleocharis parvula (R. & S.) Link	NA	
Eragrostis curtipedicellata Buckl.	NP	Gummy Lovegrass
Eragrostis swallenii Hitchc.	NP	Swallen's Lovegrass
Eriochloa punctata (L.) Desv.	NP	Louisiana Cupgrass
Erioneuron pilosum (Buckl.) Nash	NP	
Heteropogon contortus (L.) R. & S.	NP	Tanglehead
Hilaria belangeri (Steud.) Nash	NP	Curly Mesquite
Leptochloa filiformis (Lam.) Beauv.	NA	Red Spangletop
Leptoloma cognatum (Schult.) Chase	NP	Fall Witchgrass
Manisuris altissima (Poir.) Hitchc.	NP	African Jointtail
Panicum ramisetum Scribn.	NP	
Panicum texanum Buckl.	NA	Texas Millet
Pappophorum bicolor Fourn.	NP	Pink Pappusgrass
Paspalum dilatatum Poir.	NP	Dallas Grass
Paspalum floridanum Michx.	NP	Florida Paspalum
Setaria geniculata (Lam.) Beauv.	NP	Knotroot Bristlegrass
Setaria leucopila (Scribn. & Merr.) K. Schum.	NP	
Sorghum halepense (L.) Pers.	NP	Johnson Grass
Sporobolus pyramidatus (Lam.) Hitchc.	NP	Whorled Dropseed
Tragus berteronianus Schult.	IA	Spike Burgrass
Trichachne californica (Benth.) Chase	NP	Arizona Cottontop

SCIENTIFIC NAME		COMMON NAME
Trichachne patens Swall.	NP	
Trichloris pluriflora Fourn.	NP	Four-Flower Trichloris
Tridens albescens (Vasey) Woot. & Standl.	NP	White Tridens
Tridens muticus (Torr.) Nash	NP	Slim Tridens
Tridens texanus (Wats.) Nash	NP	
CYPERACEAE		SEDGE FAMILY
Cyperus ochracens Vahl.	NP	Flatsedge
Cyperus rotundus L.	NP	Nut-Grass, Tulillo
Eleocharis parvula (R.& S.) Link	NA	Spikerush
Scirpus californicus (C.A. May) Steud.	NP	Giant Bulrush, Tule
BROMELIACEAE		PINE-APPLE FAMILY
Hechtia glomerata Zucc.	NP	Guapilla
COMMELINACEA		SPIDERWORT FAMILY
Commelina diffusa Burm. f.	NA	Spreading Dayflower
Commelina erecta L. var. *angustifolia* (Michx.) Fern	NP	Hierba del Pollo
PONTEDERIACEAE		PICKEREL-WEED FAMILY
Heteranthera limosa (Sw.) Willd.	NP	Blue Mudplantain
LILIACEAE		LILY FAMILY
Yucca constricta Buckl.	NP	Buckley Yucca
Yucca tenuistyla Trel.	NP	Whiterim Yucca
AMARYLLIDACEAE		AMARYLLIS FAMILY
Cooperia drummondii Herb.	NP	Cebolleta, Brazos Rainlily
Polianthes variegata (Jacobi) Shinners	NP	Huaco, Texas Tuberosa
SALICAEAE		WILLOW FAMILY
Salix nigra Marsh var. *nigra*	NP	Black Willow, Sauz
ULMACEAE		ELM FAMILY
Celtis laevigata Willd.	NP	Palo Blanco, Sugarberry
Celtis pallida Torr.	NP	Granjeno, Desert Hackberry
MORACEAE		MULBERRY FAMILY
Morus alba L.	NP	White Mulberry, Moral Blanco
ARISTOLOCHIACEAE		BIRTHWORT FAMILY
Aristolochia longiflora Engelm. & Gray	NP	Swan-Flower
POLYGONACEAE		KNOTWEED FAMILY
Erogonum greggii T. & G.	NP	Gregg Wildbuckwheat
CHENOPODIACEAE		GOOSEFOOT FAMILY
Atriplex obovata Moq.	NP	Silver Saltbush
Chenopodium berlandieri Moq.	IA	Pitseed Goosefoot
Salsola kali L.	NA	Russian Thistle, Tumbleweed
AMARANTHACEAE		AMARANTH FAMILY
Amaranthus berlandieri (Moq.) Uline & Bray	NA	Berlandier Amaranth
Amaranthus palmeri Wats.	NA	Carelessweed, Redroot
Gomphrena globosa L.	NA	Common Globe-Amaranth
Tidestromia lanuginosa (Nutt.) Standl. var. *lanuginosa*	NA	Woolly Tidestromia, Espanta Vaqueros

SCIENTIFIC NAME		COMMON NAME
NYCTAGINACEAE		FOUR-O'CLOCK FAMILY
Acleisanthes crassifolia Gray	NP	Texas Trumpets
Acleisanthes longiflora Gray	NP	Angel Trumpets, Yerba de la Rabia
Allionia incarnata L.	NP	Hierba de la Horniga, Trailing Allionia
Boerhaavia coccinea Mill.	NP	Scarlet Spiderling
Boerhaavia erecta L.	NA	Erect Spiderling
PHYTOLACCACEAE		POKEWEED FAMILY
Phaulothamnus spinescens Gray	NP	Snake Eyes, Putia
Rivina humilis L.	NP	Pigeon-Berry, Coralito
PORTULACACEAE		PURSLANE FAMILY
Portulaca mundula I.M. Johnst.	NA	Chisme
Portulaca oleracea L.	NA	Purslane, Verdolaga
Talinum angustissimum (Gray) Woot. & Standl.	NP	Orange Flame-Flower
RANUNCULACEAE		CROWFOOT FAMILY
Clematis drummondii T. & G.	NP	Texas Virgin's Bower
MENISPERMACEAE		MOONSEED FAMILY
Cocculus diversifolius DC.	NP	Orientvine, Correhuela
PAPAVERACEAE		POPPY FAMILY
Argemone sanguinea Greene	NA	Spiny Argemone, Red Poppy
CRUCIFERAE		MUSTARD FAMILY
Lepidium virginicum L. var. *virginicum*	NA	Lentejilla
Lesquerella fendleri (Gray) Wats.	NP	Fendler Bladderpod
Nersyrenia camporum (Gray) Greene	NP	Mesa Greggia
Sibara runcinata (Wats.) Roll.	NA	
CAPPARIDACEAE		CAPER FAMILY
Polanisia dodecandra (L.) DC. subsp. *riograndensis* Iltis.	NA	Clammy Weed
LEGUMINOSAE		LEGUME FAMILY
Acacia berlandieri Benth.	NP	Guajillo
Acacia smallii Isely	NP	Huisache
Acacia rigidula Benth.	NP	Black Brush
Acacia roemeriana Scheele	NP	Catclaw, Roemer Acacia
Cassia bauhinioides Gray	NP	Two-Leaved Senna
Cercidium texanum Gray	NP	Paloverde, Retama China
Dalea pogonathera Gray	NP	Hierba del Corazon, Bearded Dalea
Desmanthus virgatus (L.) Willd. var. *depressus* (Willd.) B.L. Turner	NP	
Eysenhardtia texana Scheele	NP	Vara Dulce
Hoffmanseggia glauca (Ort.) Eifert	NP	Indian Rushpea
Mimosa wherryana (Britt. & Rose)	NP	
Parkinsonia aculeata L.	NP	Retama
Pithecellobium flexicaule (Benth.) Coult.	NP	Ebano, Texas Ebony
Prosopis glandulosa Torr. var. *torreyana* (L. Benson) M.C. Johnst.	NP	Western Honey Mesquite
Rhynchosia americana (Mill.) C. Metz	NP	American Snoutbean
Schrankia latidens (Small) K. Schum.	NP	Karnes Sensitive Briar
Sesbania drummondii (Rydb.) Cory	NP	Rattlebush, Poisonbean
Vigna luteola (Jacq.) Benth.	NP	

SCIENTIFIC NAME		COMMON NAME
KRAMERIACEAE		RATANY FAMILY
Krameria ramosissima (Gray) Wats.	NP	Manystem Ratany, Calderona
OXALIDACEAE		WOOD-SORREL FAMILY
Oxalis dichondrifolia Gray	NP	Ponyleaf, Agrito
ZYGOPHYLLACEAE		CALTROP FAMILY
Porlieria angustifolia (Engelm.) Gray	NP	Soap-Bush, Guayacan
Tribulus terrestris L.	IA	Puncturevine, Abrojo de Flor Amarilla
RUTACEAE		CITRUS FAMILY
Thamnosma texana (Gray) Torr.	NP	Ruda del Monte, Dutchman's Breeches
Zanthoxylum fagara (L.) Sarg.	NP	Colima, Una de Gato
SIMAROUBACEAE		QUASSIA FAMILY
Castela texana (T. & G.) Rose	NP	Allthorn, Chaparro Amargoso
MALPIGHIACEAE		MALPIGHIA FAMILY
Thryallis angustifolia (Benth.) O. Ktze.	NP	Narrowleaf Thryallis
POLYGALACEAE		MILKWORT FAMILY
Polygala lindheimeri Gray	NP	Shrubby Milkwort
Polygala macradenia Gray	NP	Glandleaf Milkwort
EUPHORBIACEAE		SPURGE FAMILY
Acalypha monostachya Cav.	NP	
Argythamnia humilis (Engelm. & Gray) Muell. Arg. var. *humilis*	NP	Low Wildmercury
Bernardia myricaefolia (Scheele) Wats.	NP	Oreja de Raton, Palo de Tarugo
Croton ciliatoglandulifer Ort.	NP	Mexican Croton
Croton glandulosus L. var. *lindheimeri* Muell. Arg.	NA	Lindheimer Croton
Croton incanus H.B.K.	NP	
Croton lindheimerianus Scheele var. *lindheimerianus*	NA	
Euphorbia cinerascens Engelm.	NP	Ashy Euphorbia
Euphorbia hypericifolia L.	NA	
Euphorbia serpens H.B.K.	NA	Hierba de la Golondrina
Jatropha dioica Cerv. var. *dioica*	NP	
Phyllanthus polygonoides Spreng.	NP	Knotweed
Stillingia treculiana (Muell. Arg.) I.M. Johnst.	NP	Trecul Stillingia
Tragia ramosa Torr.	NP	Catnip Noseburn
CELASTRACEAE		STAFF-TREE FAMILY
Schaefferia cuneifolia Gray	NP	Desert Yaupon, Capul
SAPINDACEAE		SOAP-BERRY FAMILY
Cardiospermum dissectum (Wats.) Radlk.	NP	
Serjania brachycarpa Gray	NP	
RHAMNACEAE		BUCKTHORN FAMILY
Colubrina texensis (T. & G.) Gray	NP	Hog Plum, Texas Colubrina
Condalia hookeri M.C. Johnst.	NP	Brasil, Bluewood
Condalia spathulata Gray	NP	Squaw-Bush
Karwinskia humboltiana (R. & S.) Zucc.	NP	Coyotillo
Ziziphus obtusifolia (T. & G.) Gray	NP	Lotebush, Clepe

SCIENTIFIC NAME		COMMON NAME
VITACEAE		GRAPE FAMILY
Cissus incisa (Nutt.) Des Moul.	NP	Hierba del Buey, Cow-Itch
MALVACEAE		MALLOW FAMILY
Abutilon wrightii Gray	NP	Wright's Abutilon
Hibiscus cardiophyllus Gray	NP	Heartleaf Hibiscus, Tulipan del Monte
Malvastrum coromandelianum (L.) Gke.	NP	Threelobe Falsemallow
Sida filipes Gray	NP	Violet Sida
Sida helleri Rose	NP	Copper Sida
Sida physocalyx Gray	NP	Spear-Leaf Sida
Sphaeralcea angustifolia (Cav.) D. Don	NP	Narrowleaf Globemallow
Sphaeralcea pedatifida Gray	NP	Palmleaf Globemallow
STERCULIACEAE		CACAO FAMILY
Melochia pyramidata L.	NP	Angelpod Melochia
COCHLOSPERMACEAE		COCHLOSPERMUM FAMILY
Amoreuxia wrightii Gray	NP	Yellowshow
KOEBERLINICEAE		ALLTHORN FAMILY
Koeberlinia spinosa Zucc. var. *tenuispina* Kearn. & Peeb.	NP	Junco, Allthorn
TURNERACEAE		TURNERA FAMILY
Turnera diffusa Willd. var. *aphrodisiaca* (Ward) Urban	NP	Damiana, Hierba del Venado
PASSIFLORACEAE		PASSION-FLOWER FAMILY
Passiflora foetida L. var *gossypifolia* (Hamilt.) Mast.	NA	Corona de Cristo
LOASACEAE		STICK-LEAF FAMILY
Cevallia sinuata Lag.	NP	Stinging Cevallia
CACTACEAE		CACTUS FAMILY
Coryphantha macromeris (Engelm.) Britt. & Rose var. *runyonii* (Britt. & Rose) L. Benson	NP	
Echinocereus enneacanthus Engelm. var. *enneacanthus*	NP	Pitaya
Echinocereus reichenbachii Terscheck var. *fitchii* (Britt. & Rose) L. Benson	NP	Lace Echinocereus
Ferocactus setispinus (Engelm.) L. Benson	NP	Hedgehog Cactus
Lophophora williamsii (Lem.) Coult.	NP	Peyote
Mammillaria escobaria Cory	NP	
Mammillaria gummifera Engelm. var. *applanta* (Engelm.) L. Benson	NP	
Opuntia leptocaulis DC.	NP	Christmas Cactus, Tasajillo
Opuntia lindheimeri Englem.	NP	Nopal Prickly Pear, Cacanapo
Opuntia schottii Engelm. var. *schottii*	NP	Devil Cholla
Thelocactus bicolor (Gal.) Britt. & Rose var. *schotti* (Engelm.) Krainz	NP	
LYTHRACEAE		LOOSESTRIFE FAMILY
Heimia salicifolia (H.B.K.) Link & Otto	NP	Hachinal
ONAGRACEAE		EVENING PRIMROSE FAMILY
Calylophus hartwegii Benth. subsp. *maccartii* (Shinners) Towner & Raven		

SCIENTIFIC NAME		COMMON NAME
PRIMULACEAE		PRIMROSE FAMILY
Samolus cuneatus Small	NP	Limerock Broodweed
SAPOTACEAE		SAPODILLA FAMILY
Bumelia celastrina H.B.K.	NP	La Coma
EBENACEAE		EBONY FAMILY
Diospyros texana Scheele	NP	Mexican Persimmon
OLEACEAE		OLIVE FAMILY
Forestiera angustifolia Torr.	NP	Desert Olive, Panalero
Fraxinus berlandieriana A. DC.	NP	Mexican Ash, Fresno
Menodora heterophylla Moric.	NP	Low Menodora
GENTIANACEAE		GENTIAN FAMILY
Eustoma exaltatum (L.) G. Don.	NA	Tall Prairiegentian, Catch-Fly Gentian
APOCYNACEAE		DOGBANE FAMILY
Macrosiphonia macrosiphon (Torr.) Heller	NP	Flor de San Juan, Plateau Rocktrumpet
ASCLEPIADACEAE		MILKWEED FAMILY
Asclepias oenotheroides Cham. & Schlecht.	NP	Hierba de Zizotes
Cynanchum barbigerum (Scheele) Sinners var. *barbigerum*	NP	Bearded Shallowwort
Matelea gonocarpa (Walt.) Shinners	NP	
Matelea parviflora (Torr.) Woods	NP	Littleleaf Milkvine
CONVOLVULACEAE		MORNING GLORY FAMILY
Convolvulus equitans Benth.	NP	Texas Bindweed
Cuscuta umbellata H.B.K.	NA	Flatglobe Dodder
Dichondra macrantha Urban.	NP	
Evolvulus alsinoides L. var. *hirticaulis* Torr.	NP	Ojo de Vibora
Ipomoea amnicola Morong.	IP	
Ipomoea sinuata Ort.	NP	Alamo Vine, Correhuela de las Doce
POLEMONIACEAE		PHLOX FAMILY
Gilia ludens Shinners	NP	
BORAGINACEAE		BORAGE FAMILY
Coldenia canescens DC.	NP	Gray Coldenia, Oreja de Perro
Cordia boissieri A. DC.	NP	Anacachute
Ehretia anacua (Berl.) I.M. Johnst.	NP	Anaqua
Heliotropium confertifolium (Torr.) Gray	NP	Leafy Heliotrope
Heliotropium curassavicum L. var. *curassivicum*	NP	Quailplant, Cola de Mico
Heliotropium texanum I.M. Johnst.	NA	Texas Heliotrope
VERBENACEAE		VERVAIN FAMILY
Aloysia gratissima (Gill. & Hook.) Troncoso var. *schulzae* (Standl.) Moldenke	NP	Bee-Blossom, Cedron
Aloysia macrostachya (Torr.) Moldenke	NP	Woolly Bee-Brush
Citharexylum brachyanthum (Gray) Gray	NP	Chile de Pajaro, Boxthorn Fiddlewood
Lantana horrida H.B.K.	NP	Hierba de Cristo, Common Lantana
Lantana macropoda Torr.	NP	Desert Lantana, Hierba Negra
Lippia graveolens H.B.K.	NP	Hierba Dulce, Red Bush, Oregano Cimarron
Phyla incisa Small	NP	Frogfruit
Verbena neomexicana (Gray) Small	NP	Hillside Vervain

SCIENTIFIC NAME		COMMON NAME
LABIATAE		MINT FAMILY
Salvia ballotaeflora Benth.	NP	Blue Sage, Mejorana
Teucrium cubense Jacq.	NA	Small Coast Germander
SOLANACEAE		POTATO FAMILY
Chamaesaracha conoides (Dun.) Britt.	NP	
Lycium berlandieri Dunal	NP	Berlandier Wolfberry
Nicotiana glauca Grah.	IP	Tree Tobacco, Rape
Nicotiana repanda Willd.	NA	Tobacco Cimarron, Fiddleleaf Tobacco
Nicotiana trigonophylla Dun.	NP	Desert Tobacco, Tabaquillo
Petunia parviflora Juss.	IA	Wild Petunia
Physalis lobata Torr.	NP	Purple Ground Cherry
Physalis pubescens L. var. *integrifolia* (Dun.) Waterfall	NA	Tomate Fresadilla, Downy Ground Cherry
Solanum eleagnifolium Cav.	NP	Silverleaf Nightshade, Trompillo
SCROPHULARIACEAE		FIGWORT FAMILY
Leucophyllum frutescens (Berl.) I.M. Johnst.	NP	Texas Silverleaf, Cenizo
Maurandya antirrhinifolia Humb. & Bonpl.	NP	Snapdragon Maurandya
MARTYNIACEAE		UNICORN PLANT FAMILY
Proboscidea louisianica (Mill.) Thell.	NA	Unicorn-Plant
ACANTHACEAE		ACANTHUS FAMILY
Dicliptera brachiata (Pursh) Spreng.	NP	
Ruellia nudiflora (Gray) Urban.	NP	Violet Ruellia
Ruellia runyonii Tharp & Barkl.	NP	
Siphonoglossa pilosella (Nees) Torr.	NP	Hairy Tubetongue
RUBIACEAE		MADDER FAMILY
Cephalanthus occidentalis L.	NP	Honey-Balls, Common Buttonbush
CUCURBITACEAE		GOURD FAMILY
Ibervillea tripartita (Naud.) Greene	NP	
Melothria pendula L.	NP	Meloncito
COMPOSITAE		SUNFLOWER FAMILY
Ambrosia psilostachya DC.	NP	Western Ragweed
Aster spinosus Benth.	NP	Mexican Devilweed
Baccharis glutinosa Pers.	NP	Seepwillow
Baccharis salicena T. & G.	NP	Willow Baccharis
Bahia absinthifolia Benth.	NP	Hairyseed Bahia
Borrichia frutescens (L.) DC.	NP	Sea Ox-Eye Daisy
Calyptocarpus vialis Less.	NP	Hierba del Caballo
Chaetopappa asteroides (Nutt.) DC.	NA	Common Leastdaisy
Conyza canadense (L.) Cronquist	NA	Horse-Weed
Dyssodia pentachaeta (DC.) Robinson	NA	Parralena
Eclipta alba (L.) Hassk.	NA	Yerba del Tajo
Ericameria austrotexana M.C. Johnst.	NP	
Florestina tripteris DC.	NA	
Gaillardia pinnatifida Torr.	NP	Slender Gaillardia
Gaillardia pulchella Foug.	NA	Indian Fireblanket, Firewhell
Helenium quadridentatum Labill.	NA	Longdisk Sneezeweed
Heterotheca latifolia Buckl. var. *Latifolia*	NP	
Isocoma coronopifolia (Gray) Greene	NP	

SCIENTIFIC NAME		COMMON NAME
Machaeranthera phyllocephala (DC.) Shinners	NA	.Camphor Daisy
Melampodium cinereum DC. var. *cinereum*	NP	.Hoary Blackfoot
Palafoxia texana DC.	NA	Texas Palafoxia
Parthenium confertum Gray	NP	
Pectis tenella DC.	NA	.Limoncillo, Low Pectis
Pluchea purpurascens (Sw.) DC.	NA	Canela
Ratibida columnaris (Sims) D. Don.	NP	.Upright Prairie Coneflower
Sonchus asper (L.) Hill	IA	Prickly Sowthistle
Taraxacum officinale Wiggers	IP	.Common Dandelion
Thelesperma megapotamicum (Spreng.) Ktz.	NP	
Varilla texana Gray	NP	.Saladillo
Verbesina encelioides (Cav.) Gray	NA	Cowpen Daisy
Vernonia missurica Raf.	NP	Missouri Ironweed
Viguiera stenoloba Blake	NP	Resin-Bush, Skeleton-Goldeneye
Xanthocephalum sphaerocephalum (Gray) Shinners	NA	.Roundleaf Broomweed
Zexmenia brevifolia Gray	NP	.Shortthorn Zexmenia
Zexmenia hispida (H.B.K.) Gray	NP	

THE AMPHIBIAN, REPTILIAN, AND MAMMALIAM FAUNA OF THE SUBTROPICAL THORN FOREST OF STARR COUNTY, TEXAS

James F. Scudday and La Ferne Scudday

The study area covered in this report is a rather limited area bordered on the west by the Rio Grande, on the north by Falcon Dam and Farm-to-Market Road 2098, on the east by Farm-to-Market Road 2098 and U.S. Highway 83, and on the south by Farm-to-Market Road 650 from U.S. Highway 83 to Fronton. Most of the area consists of gravelly, slightly rolling terrain, sloping toward the Rio Grande flood plain where arroyos become increasingly deeper as the river is neared. The Rio Grande flood plain is densely covered by riparian species of trees and shrubs and today represents one of the few fragments of such native vegetation still existing in south Texas.

Dice (1943) included only the extreme southern tip of Texas in his Tamaulipan Biotic Province. The study area lies on the northern boundary of this province according to Dice. He characterized the Tamaulipan Province as being practically frost-free and having a dense growth of thorny shrubs and trees, high temperatures most of the year, and a high air humidity coupled with rapid evaporation of moisture from the soil. Blair (1950) modified Dice's boundaries by extending the Tamaulipan northward to the southern boundary of the Edwards Plateau. Essentially, Blair simply added a rather wide transitional belt to the Tamaulipan instead of including it with the Texas Biotic Province to the northeast. His decision was based more on soil types than anything else. Also, Blair suggested that a narrow strip, representing the lower Rio Grande Valley in Texas and Mexico, could be treated as a separate and distinct biotic province from the Tamaulipan because of the distinctness and density of its riparian vegetation (Fig. 1). He proposed the name Matamoran for this province. Except for the avifauna, there is little to suggest such separation in terms of animal distribution.

Vegetational and faunal elements found in the Tamaulipan Biotic Province generally show a strong Neotropical influence. The image conjured when the south Texas brush country is mentioned is one of palms and citrus groves, exotic birds and beasts, and hot temperatures. The area certainly is distinct in many ways from the rest of Texas, yet much of its vertebrate fauna is also typical of that found in adjoining parts of the state. The Chihuahuan Biotic Province especially shows a strong influence on the fauna of the study area.

When one compares the species documented as occurring within the study area in our July survey with the species whose known geographical range encompasses the study area, it is obvious that less than 50% of those species that might be encountered were actually found. Some species should be considered only hypothetical, because either the study area is at the marginal limits of their range or the species is so rare that it has been recorded from only one or two nearby localities. The hypothetical category would include such amphibians as the Sheep Frog (*Hypopachus cuneus*) and the Rio Grande Frog (*Syrrhophus cystignathoides*), snakes such as the Cat-eyed Snake (*Leptodeira septentrionalis*) and the Scarlet Snake (*Cemophora coccinea*), lizards such as the Green Anole (*Anolis carolinensis*) and Keeled Earless Lizards (*Holbrookia propingua*), and mammals such as the Coati (*Nasua nasua*), and the Yellow Bat (*Lasiurus intermedius*). Perhaps the questionable status of so many vertebrates in this category illustrates the important transitional position of the study area.

A second category of "missing" species would be those kinds that were never abundant, and, due to alteration of habitat and general impact of humans, probably no longer even exist in the entire general area. This would include the large carnivores such as the Jaguar (*Felis onca*) and the Jagurundi (*Felis yagouaroundi*).

A third category would include those species that were once abundant, and may still be common during propitious seasons or years, but whose populations have been greatly reduced due to their "varmint" status. This includes most species of snakes, particularly the venomous ones, small carnivores such as skunks and foxes, and numerous other small vertebrates that arouse the ire of man for some reason or other. These species are "probably" present in the area, but due to low numbers or adverse seasonal climatic conditions, they were not represented in our census.

Based upon the above discussion, the lists of vertebrate species occurring within the study area attempt

to categorize each species as: (D), present and documented during the July survey; (P), probably present in the area, but, due to low numbers or adverse seasonal climatic conditions, not present in our census; (H), hypothetically possible, that is, one whose known range of distribution approaches the study area, but no specimens actually are known from within it; and (X), those species known historically to have occurred in or near the study area but no longer there, or whose occurrence would now be considered accidental.

Amphibian and reptilian nomenclature is according to Thomas (1974) and Conant (1975). Mammalian nomenclature is after Jones, et al. (1973).

AMPHIBIANS

CLASS AMPHIBIA

Order Caudata
- Family Sirenidae ..... *Siren intermedia*—Lesser Siren (P)
- Family Ambystomatidea ..... *Ambystoma tigrinum*—Tiger Salamander (D)

Order Anura
- Family Rhinophrynidae ..... *Rhinophrynus dorsalis*—Mexican Burrowing Frog (D)
- Family Pelobatidae ..... *Scaphiopus couchi*—Couch's Spadefoot (D)
  - *S. bombifrons*—Plains Spadefoot (P)
- Family Leptodactylidae ..... *Leptodactylus labialis*—Mexican White-lipped Frog (D)
  - *Syrrhophus cystignathoides*—Rio Grande Frog (H)
- Family Hylidae ..... *Acris crepitans*—Cricket Frog (D)
  - *Pseudacris clarki*—Spotted Chorus Frog (H)
- Family Bufonidae ..... *Bufo debilis*—Green Toad (D)
  - *B. marinus*—Giant Toad (D)
  - *B. punctatus*—Red spotted Toad (D)
  - *B. speciosus*—Texas Toad (D)
  - *B. valliceps*—Gulf Coast Toad (D)
  - *B. woodhousei*—Woodhouse's Toad (H)
- Family Ranidae ..... *Rana berlanderi*—Rio Grande Leopard Frog (D)
  - *R. catesbeiana*—Bull Frog (P)
- Family Microhylidae ..... *Gastrophryne olivaceae*—Great Plains Narrow-mouthed Toad (D)
  - *Hypopachus cuneus*—Sheep Frog (H)

Two species of caudates and 17 species of anurans were collected, were observed, or are known to occur within the study area. Lesser Sirens have been taken from the Rio Grande, flooded oxbows, and ponds near the river. The south Texas form of the Lesser Siren has been an enigma for salamander systematists. It is presently recognized as a subspecies of the Lesser Siren, *Siren intermedia texana* (Conant 1975).

Tiger Salamanders are more likely to be found in stock ponds away from the river. We seined two transforming individuals from a small pond near the intersection of old U.S. Highway 83 and the dirt road to Santa Margarita.

Two unique anuran species were documented from the study area. These were the Mexican Burrowing Toad and the Mexican White-lipped Frog. These are both Mexican species that reach their northernmost distributional limits in Starr County. The Mexican White-lipped Frog has been placed on a list of amphibians and reptiles to be protected from general collecting in the State of Texas.

Of the five species of *Bufo* collected, the Giant Toad has the most limited Texas distribution. This large toad ranges from the tropics of South America just into the southern tip of Texas. The venom secreted by the skin glands is especially toxic and was the cause of considerable alarm when the Giant Toad was found to have been established through man-caused introductions into the tropics of Florida a number of years ago. The great size of this species is its most striking characteristic (Fig. 2).

Only two of the hypothetical species listed represent important Texas records. The Rio Grande Frog is known from Texas only from neighboring Hidalgo and Cameron counties. It could well occur also along the Rio Grande to Falcon Dam. The Sheep Frog occurs from Hidalgo and Cameron counties northward through the eastern part of Starr County. It too might well occur within the study area. The other two hypothetical species, the Spotted Chorus Frog and Woodhouse's Toad, occur widely throughout much of Texas, and the study area represents more of a marginal southern part of their range.

FIGURE 1

Riparian habitat along the Rio Grande near Santa Margarita. Blair (1950) suggested that such habitat extending along the Rio Grande in south Texas could be recognized as a distinct biotic province. Little remains of this type habitat in south Texas. Ideal turtle and Beaver habitat. Note high water marks on trees.

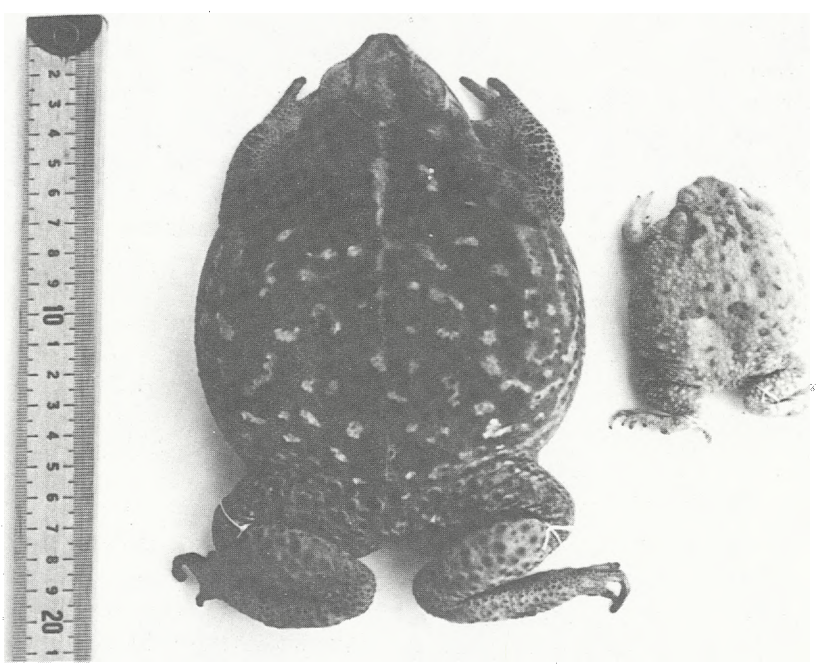


FIGURE 2

A Giant Toad (*Bufo marinus*) on the right compared with an average-sized Texas Toad (*B. speciosus*) on the left.

REPTILES

CLASS REPTILIA

Order Chelonia

- Family Kinosternidae — *Kinosternon flavescens*—Yellow Musk Turtle (D)
- Family Emydidae — *Chrysemys concinna*—River Cooter (P)
  - *C. scripta*—Red-eared Turtle (D)
- Family Testudinidae — *Gopherus berlandieri*—Texas Tortoise (D)
- Family Trionychidae — *Trionyx spiniferus*—Spiny Softshell (D)

Order Squamata

Suborder Lacertilla – Lizards

- Family Geckkonidae — *Hemidactylus turcicus*—Mediterranean Gecko (D)
  - *Coleonyx brevis*—Texas Banded Gecko (D)
- Family Iguanidae — *Anolis carolinensis*—Green Anole (H)
  - *Cophosaurus texanus*—Greater Earless Lizard (D)
  - *Crotaphytus reticulatus*—Reticulate Collared Lizard (D)
  - *Holbrookia lacerta*—Spot-tailed Earless Lizard (P)
  - *H. propinqua*—Keeled Earless Lizard (H)
  - *Phrynosoma cornutum*—Texas Horned Lizard (D)
  - *Sceloporus cyanogenys*—Blue Spiny Lizard (D)
  - *S. olivaceus*—Texas Spiny Lizard (D)
  - *S. variabilis*—Rose-bellied Lizard (D)
  - *S. grammicus*—Mesquite Lizard (P)
  - *S. undulatus*—Eastern Fence Lizard (P)
  - *Urosaurus ornatus*—Tree Lizard (D)
- Family Scincidae — *Eumeces obsoletus*—Great Plains Skin (D)
  - *E. tetragammus*—Four-lined Skink (D)
- Family Teiidae — *Cnemidophorus gularis*—Texas Spotted Whiptail (D)
  - *C. sexlineatus*—Six-lined Racerunner (P)

Suborder Serpentes

- Family Leptotyphlopidae — *Leptotyphlops dulcis*—Plains Blind Snake (P)
- Family Colubridae — *Natrix rhombifera*—Diamondback Watersnake (H)
  - *N. erythrogaster*—Yellow-bellied Watersnake (H)
  - *Thamnophis marcianus*—Checkered Gartersnake (D)
  - *T. proximus*—Ribbon Snake (P)
  - *Coluber constrictor oaxaca*—Mexican Blue Racer (H)
  - *Masticophis flagellum*—Coachwhip (D)
  - *M. taeniatus*—Whipsnake (D)
  - *Drymarchon corais*—Indigo Snake (D)
  - *Salvadora grahamiae*—Texas Patch-nosed Snake (P)
  - *Arizona elegans*—Glossy Snake (P)
  - *Opheodrys aestivus*—Rough Green Snake (P)
  - *Pituophis melanoleucus*—Bullsnake (P)
  - *Storeria dekayi*—Brown Snake (H)
  - *Lampropletis getulus*—Desert Kingsnake (P)
  - *L. triangulum*—Mexican Milksnake (P)
  - *Sonora episcopa taylori*—South Texas Ground Snake (P)
  - *Cemophora coccinea*—Scarlet Snake (H)
  - *Heterodon nasicus*—Western Hog-nosed Snake (P)
  - *Ficimia streckeri*—Mexican Hook-nosed Snake (H)
  - *Tantilla nigriceps*—Texas Black-headed Snake (P)
  - *T. gracilis*—Flat-headed Snake (P)
  - *Elaphe guttata*—Great Plains Ratsnake (D)
  - *Leptodeira septentrionalis*—Cat-eyed Snake (H)

Family Viperidae ..... *Crotalus atrox*—Western Diamondback Rattlesnake (D)
Sistrurus catenatus—Massassauga (H)
Family Elapidae ..... *Micrurus fulvius*—Coral Snake (P)

Lizards were the only reptilian forms commonly found within the study area. Snakes were surprisingly scarce in spite of warnings from residents of the area that snakes were "everywhere." Ten days of searching under old logs, boards, sheets of tin, and brush piles turned up few species for documentation. A man showed us a recently killed Indigo Snake in his backyard. Discussions with other residents of the area indicated a tendency to kill all snakes, whether harmful or not. This, coupled with the fact that the survey was conducted during a time of the year in which many snakes estivate to escape the extremely hot weather, may account for our paucity of snake records. Lizards are generally considered innocuous, however, and, although not well-liked or understood, little effort is made to eradicate them from premises.

The Texas Spotted Whiptail was the most commonly seen lizard throughout the study area. Copulation by whiptails was observed a number of times. Copulation in July indicates that Spotted Whiptails might produce two clutches of eggs in south Texas.

Six-lined Racerunners are common throughout most of south Texas. Why this species was not found within the study area is not known.

Blue Spiny Lizards are extremely abundant among the rocks forming a part of Falcon Dam. This large swift is generally found only where rocks are available, raising some interesting questions about their dispersal into man-made rocky environments isolated from rocky outcrops. We found a number of old rock ruins throughout the study area that were miles from the nearest natural rock outcrops, yet Blue Spiny Lizards were nearly always present among the ruins. They were especially abundant among the three old rock houses near Los Arrierous Cemetary (Fig. 3), and at the ruins locally referred to as Casas Blancas (Fig. 4).

The Blue Spiny Lizard is one of several Mexican species that reaches its northernmost distribution in extreme southern Texas. This large beautifully marked lizard is extremely wary and difficult to approach closely. Several areas within the study area would be ideal sites for observing and learning more about this species.

The Rose-bellied Lizard and the Mesquite Lizard are two other sceloperine lizards that are primarily Mexican and occur in the United States only in the southern tip of Texas. A single Rose-bellied Lizard was captured at the Casa Yankee ruins. The Mesquite Lizard was not documented for the study area, but the area is within its known distributional range.

Perhaps one of the most interesting lizards in Texas is the Reticulate Collard Lizard (Fig. 5). This harmless lizard more than any other reptile might be considered the typical representative of the northern Tamaulipan Biotic Province. It is a large handsome lizard and the center of a number of superstitions among the local inhabitants. One person told us the lizard was extremely venomous, and he suspected it of causing the disappearance of some of his baby chicks.

Reticulate Collard Lizards were most often found on the sparsely brush covered slopes leading to the river. We saw only one near the edge of the dense brush near the river. A number of specimens were picked up dead on roads, indicating they like to sun in open areas and roadways.

Besides Texas Spotted Whiptails, Four-lined Skinks were the lizards most commonly encountered in the thick brush and trees near the river. These secretive lizards are difficult to find and catch. They often stay beneath the loose bark of old dead trees or burrow beneath leaf cover on the ground. A single Great Plains Skink was captured near the Casa Yankee ruins. It was sharing its shelter beneath an old car door with a Great Plains Ratsnake.

Two Geckos occur within the study area. The Mediterranean Gecko was common on the walls of brick homes and office buildings in Falcon Village and at the Immigration Service Inspection Station on Falcon Dam. These little exotic night lizards were inadvertently introduced into the United States years ago and have become common throughout south Texas. They are almost always found in association with man and his dwellings. Porch lights, spot lights, and other forms of outdoor lighting are especially beneficial to them as the lights attract insects upon which the geckos prey.

The Texas Banded Gecko is a native species and is more difficult to find. These little night hunters can sometimes be found hiding beneath rocks, old boards, and other such objects during the day. We collected several specimens from the trash dump near Salineño where we found them beneath old cardboard cartons. It is doubtful that any competition occurs between the exotic and native geckos because of differences in their habits and adaptations.

Of the two hypothetical lizards for the area, the Keeled Earless Lizard is the most important. This

FIGURE 3

One of the three old rock houses located near the Los Arrierous Cemetery. Blue Spiny Lizards (*Sceloporus cyanogenys*) were especially numerous here. Note the many openings and spaces between the rocks affording adequate hiding places.

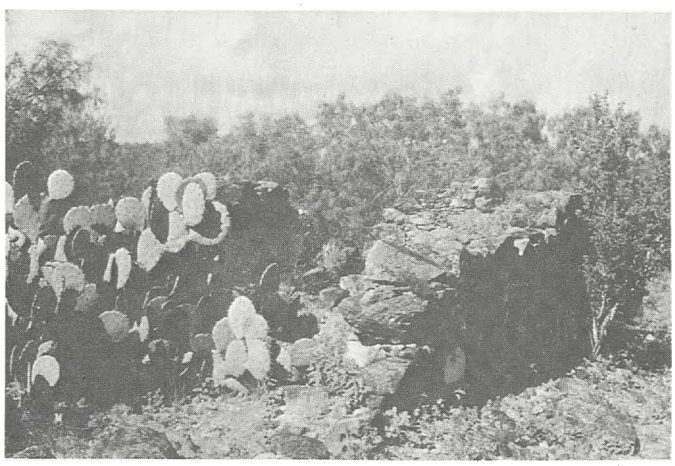


FIGURE 4

One of the many rock-walled ruins at Casas Blancas. Even these small remnants supported isolated populations of Blue Spiny Lizards (*Sceloporus cyanogenys*).

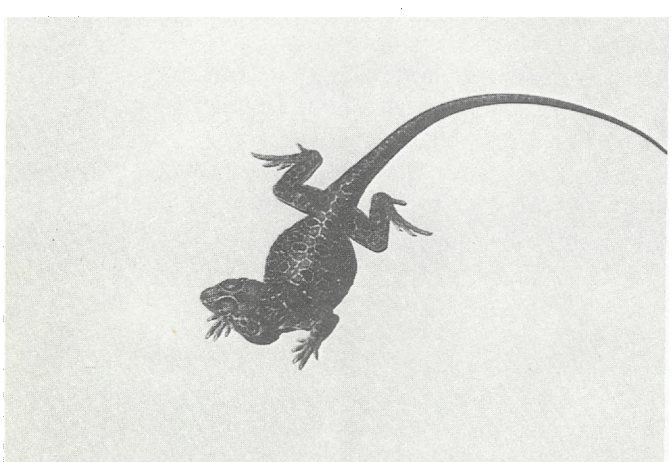


FIGURE 5

A Reticulate Collared Lizard (*Crotaphytus reticulatus*). These handsome lizards are relatively common within the study area.

FIGURE 6

A pair of Texas Tortoises. Pictured here is a male that has tracked a female to her burrow.

small earless lizard is generally confined to the Tamaulipan and south Texas coast. Conant (1975) shows the range extending westward in south Texas to the Rio Grande in Starr County. The Green Anole is primarily an arboreal eastern species that reaches its south-westernmost distribution in south Texas. Habitat along the Rio Grande appears to be ideal for the species.

As previously mentioned, snakes were extremely scarce in the study area in late July, 1975. Only six species were documented for the study area. Of the six, only the Coachwhip seemed to be relatively numerous. All other species were documented on the basis of a single specimen. Thirteen additional species are likely within the area, while another eight are listed as hypothetical.

Most of the probable and many of the hypothetical species do not represent significant Texas records. The South Texas Ground Snake is the most important of the probables. As the name implies, this is a south Texas subspecies of *Sonora episcopa.*

Interestingly, Conant (1975) shows the distribution of the Blotched Water Snake from the Rio Grande in south Texas westward into Mexico. Conant also shows a disjunct distribution for the Diamondback Water Snake, with a skip over the study area, and a small isolated area of occurrence along the Rio Grande in Cameron County. Both these water snakes could be expected in the study area.

Perhaps the hypothetical snake of greatest interest would be the Cat-eyed Snake. This snake occurs with some regularity in Cameron and Hidalgo counties and certainly might be expected in Starr County. *Leptodeira* is a rather large genus containing a number of Mexican species with only *L. septentrionalis* occurring northward into extreme south Texas. This snake is a rear-fanged snake and large specimens could theoretically be dangerous to a person handling it. Its venom is most likely of a low toxicity to warm-blooded animals but quite effective on lizards.

Another snake with a restricted Texas distribution is the Mexican Hook-nosed Snake. This species is known from near Laredo southward into Mexico. Little is known of its life history in south Texas.

The Mexican Blue Racer is a south Texas form of *Coluber constrictor.* Conant (1975) shows it occurring east and south of the study area. Because of its preference for thick brush, it should be looked for among the subtropical woodland along the Rio Grande.

Four of the five turtles expected in the study area were documented. Spiny Softshells and Red Ear Turtles apparently are common in the river, while Yellow Musk Turtles prefer small ponds. Texas Tortoises often were encountered throughout the brushy slopes and flats (Fig. 6), and four specimens that had been hit by cars were collected from roads and highways. Courtship and copulation were observed several times among Texas Tortoises. Occurrence of the River Cooter was not documented, but it probably does occur in the Rio Grande.

MAMMALS

CLASS MAMMALIA

Order Marsupialia
- Family Didelphidae ..... *Didelphis virginiana*—Opossum (D)

Order Insectivora
- Family Soricidae ..... *Cryptotis parva*—Least Shrew (P)
  Notiosorex crawfordi—Desert Shrew (H)
- Family Talpidae ..... *Scalopus aquaticus*—Eastern Mole (P)

Order Chiroptera
- Family Mormoopidae ..... *Mormoops megalophylla*—Ghost-faced Bat (H)
- Family Vespertilionidae ..... *Pipistrellus subflavus*—Eastern Pipistrelle (H)
  Lasiurus borealis—Red Bat (H)
  L. cinereus—Hoary Bat (P)
  L. intermedius—Northern Yellow Bat (H)
  Antrozous pallidus—Pallid Bat (P)
- Family Molossidae ..... *Tadarida brasiliensis*—Brazilian (=Mexican) Free-tailed Bat (P)
  T. macrotis—Big Free-tailed Bat (H)

Order Edentata
- Family Dasypodidae ..... *Dasypus novemcinctus*—Nine-banded Armadillo (D)

Order Lagomorpha
- Family Leporidae ..... *Sylvilagus floridanus*—Eastern Cottontail (P)
  - *S. audubonii*—Desert Cottontail (D)
  - *Lepus californicus*—Black-tailed Jack Rabbit (D)

Order Rodentia
- Family Sciuridae ..... *Spermophilus mexicana*—Mexican Ground Squirrel (D)
  - *S. spilosoma*—Spotted Ground Squirrel (P)
- Family Heteromyidae ..... *Perognathus merriami*—Merriam's Pocket Mouse (D)
  - *P. hispidus*—Hispid Pocket Mouse (D)
  - *Dipodomys ordii*—Ord's Kangaroo Rat (D)
- Family Geomyidae ..... *Geomys personatus*—South Texas Pocket Gopher (H)
- Family Castoridae ..... *Castor canadensis*—Beaver (D)
- Family Cricetidae ..... *Reithrodontomys fulvescens*—Fulvous Harvest Mouse (P)
  - *Peromyscus leucopus*—White-footed Mouse (D)
  - *P. maniculatus*—Deer Mouse (H)
  - *Onychomys leucogaster*—Northern Grasshopper Mouse (P)
  - *Sigmodon hispidus*—Cotton Rat (D)
  - *Neotoma micropus*—Southern Plains Woodrat (D)
- Family Muridae ..... *Rattus rattus*—Black Rat (P)
  - *Mus musculus*—House Mouse (D)
- Family Capromyidae ..... *Myocastor coypus*—Nutria (P)

Order Carnivora
- Family Canidae ..... *Canis latrans*—Coyote (D)
  - *Urocyon cinereoargenteus*—Gray Fox (P)
- Family Procyonidae ..... *Procyon lotor*—Raccoon (D)
  - *Nasua nasua*—Coati (H)
- Family Mustelidae ..... *Mustela frenata*—Long-tailed Weasel (H)
  - *Taxidea taxus*—Badger (P)
  - *Spilogale putorius*—Eastern Spotted Skunk (H)
  - *S. gracilis*—Western Spotted Skunk (P)
  - *Mephitis mephitis*—Striped Skunk (D)
- Family Felidae ..... *Felis onca*—Jaguar (X)
  - *F. concolor*—Mountain Lion (X-P)
  - *F. paradalis*—Ocelot (X)
  - *F. yagouaroundi*—Jaguarundi (X)
  - *Lynx rufus*—Bobcat (P)

Order Artiodactyla
- Family Tayassuidae ..... *Dicotyles tajacu*—Javelina or Collared Peccary (X-P)
- Family Cervidae ..... *Odocoileus virginianus*—White-tailed Deer (D)

Mammalian records for the lower Rio Grande Valley of Texas are rather extensive for the years prior to the 1950s. Since that time many species have been extirpated or greatly reduced in numbers due to clearing of native brushlands for agricultural purposes and a general increase in human activities of all kinds. The first mammals to be affected by such changes are the larger carnivores existing on the periphery of their range. Jaguars, Ocelots, and Jagarundis, typically Tamaulipian forms, were probably never very abundant in south Texas, but they are now considered essentially nonexistent. The corridors through which these mammals once moved from Mexico into Texas also no longer exist. Mountain Lions, Bobcats, Badgers, and even the ubiquitous Raccoon and Gray Fox are greatly reduced in numbers. The varmint status of these, as well as others, has contributed greatly to their decline. Only the Coyote appears to do little more than hold its own.

Despite the preservation of the study area's vegetative character, increased human usage since the completion of Falcon Dam has had a deleterious effect upon some components of the vertebrate fauna. Because it is but a small part of all that remains of the original native vegetation and because of easy access to some of the area, it is heavily utilized by large numbers of people on weekends and holidays for recreational purposes. Heavily utilized

areas were almost devoid of snakes, lizards, and mammals, and even the birds seemed more wary. Some areas lower along the river, however, are not as accessible, and it can be hoped that these areas might retain some vestige of the original mammalian elements as they do the original vegetation.

The untimely season of the year could also account for our paucity of records for small mammals. These kinds of mammals are generally much more difficult to trap in summer when food is plentiful.

Fortunately, we were able to confer with Stan Hayes, a graduate student from Texas A&M University, who had been trapping animals in the area for over a month in conjunction with a fever tick project. His observations and results are included with our records.

Three insectivores are recorded from South Texas, and likely occur in suitable habitat within the study area. The Desert Shrew is one of the most secretive mammals in Texas. It has been taken from a variety of habitats within the state but never seems to occur in high densities.

The Little Short Tailed Shrew is the most likely insectivore to be found in the study area. Stan Hayes had not captured any after a month of intensive trapping on the island below Falcon Dan. Yet suitable habitat is plentiful throughout the area. No evidence of Eastern Mole tunnels was seen, but an employee of the International Boundary Commission told us that he killed one in 1974 in his yard at Falcon Village.

No bats were seen during the July survey, although likely looking roosting sites in old houses were investigated. We did not even see any foraging bats at dusk nor hear them after dark. Davis (1975) shows the study area to be within the distributional range of at least seven species. Another species, the Northern Yellow Bat (*Lasiurus intermedius*), is hypothetical for the area, with a known county record from neighboring Hidalgo County (Davis 1975).

The two species of cottontail rabbits occurring in south Texas are difficult to separate with certainty without having specimens in hand. Cottontails were numerous and seen in practically all kinds of habitat throughout the census period. Two Cottontails found dead on U.S. Highway 83 were Desert Cottontails. Eastern Cottontails probably would prefer the denser brush of the riparian community near the river. We did not ascertain the presence of Eastern Cottontails, but Davis (1975) shows them in all of south Texas with known county records from Starr County.

Mexican Ground Squirrels, Hispid Pocket Mice, Jackrabbits, and Coyotes appeared to be the most numerous kinds of mammals occurring within the study area. Mexican Ground Squirrels were the only mammals commonly seen during daylight hours, while Hispid Pocket Mice were the most commonly captured rodent at night. Jackrabbits were observed at dusk and on the roads at night. Coyotes were often heard, and their tracks and scat were seen throughout the area.

The south Texas Pocket Gopher is found throughout most of south Texas. However, Kennerly (1954) shows it is absent from the clayey soils prevalent in most of the study area. We did not find any indication of Pocket Gophers west of U.S. 83.

Although no Beavers were actually seen, evidence of their presence was sometimes found among willow thickets along the river (Fig. 7). Beavers probably are not numerous, as signs of their activity were sparse. Taxonomically, the lower Rio Grande Beaver is the same race (*Castor canadensis mexicanus*) that is making a strong population recovery in the Big Bend region of far west Texas.

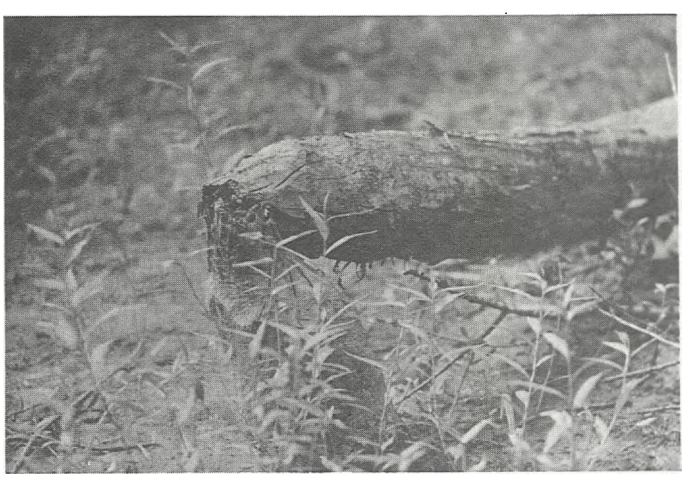


FIGURE 7

A willow tree that was felled by beavers. Beavers do not appear to be numerous in the study area.

The systematic status of spotted skunks long has been a thorny problem. Howell (1906) recognized three species as occurring in Texas. Hall and Kelson (1959) recognized only two, with *Spilogale putorious* inhabiting the eastern half of Texas and *S. gracilis* inhabiting the western portion of the state. Later authors considered the two species to be conspecific. Benirschke (1967) demonstrated that *S. gracilis* exhibited delayed implantation and had 64 chromosomes, and Hsu and Benirschke (1967) showed that *S. putorius* does not exhibit delayed implantation and has only 60 chromosomes. Patton (1974) briefly reviewed the problem, and stated that areas of sympatry of the two species needed to be defined and established. External differences between the two are subtle and cannot be completely relied upon for separation of the species.

According to Davis' (1975) distribution maps, the present study area falls within a zone of overlap of the two species, with the Western Spotted Skunk being the one most likely found here. If both species do indeed occur here, the area represents a potential study site to further elucidate parameters upon which to separate the two species.

In conversations with Roy McBride, a knowledgeable biologist and carnivore specialist, we learned that Ocelots and Jagarundis have seldom been found west of U.S. 281 (the highway from Alice to Edinburgh) since the 1920s. The greater majority of recent cat records for south Texas have occurred along the coastal side of the region. He doubts that there are still any of these big cats resident within the study area but doesn't rule out the outside chance of a wandering individual passing through. McBride states that there is a small relict Ocelot population along the gulf side of Cameron, Kenedy, and Willacy counties. Texas records for Jaguars are widespread and generally occurred prior to the 1930s. This coincides fairly well with the time when intensive brush clearing began in south Texas. Today any Jaguar or Jaguarundi reported from anywhere in Texas would have to be an accidental wanderer from Mexico.

The only wild felines likely to be found within the study area are the Bobcat (most likely) and an occasional (very rarely) itinerant Mountain Lion.

Javelinas once occurred within the area, but, according to Stan Hayes who had interviewed local residents about mammals of the area, no Javelinas have been seen for the previous three or four years. These peccaries are common throughout most of south Texas and the reintroduction of Javelinas to the area could occur by natural means.

Deer were generally scarce in the area. The only place that deer were readily seen was on the federal land just below Falcon Dam. At least a dozen different individuals were seen watering in late afternoon just below the spot where the spillway channel enters the river.

We wish to acknowledge the help we received from Stan Hayes in compiling our mammalian records. His work in the area for over a month prior to our arrival and his willingness to share his information with us were invaluable.

LITERATURE CITED

Benirschke, K. 1967. Sterility and fertility of interspecific mammalian hybrids. *Comparative aspects of reproductive failure.* K. Benirschke, editor. Springer-Verlay, Inc., New York, pp. 220-235.

Blair, W. F. 1950. The biotic provinces of Texas. *Tex. Journ. Sci.,* 2:93-117.

Conant, R. 1975. *A Field Guide to Reptiles and Amphibians of Eastern and Central North America.* 2nd Edition. Houghton Mifflin Company. 429 pp.

Davis, W. B. 1975. *The mammals of Texas.* 2nd ed. Texas Parks and Wildlife Dept. Bulletin 41. 294 pp.

Dice, L. R. 1943. *The Biotic Provinces of North America.* Univ. of Mich. Press, Ann Arbor.

Hall, E. R. and Kelson, K. R. 1959. *The Mammals of North America.* Roland Press, New York, 2:547-1083.

Howell, A. H. 1906. Revision of the skunks of the genus *Spilogale. N. Amer. Fauna,* 26:1-55.

Hsu, T. C. and Benirschke, K., editors. 1967. *An atlas of mammalian chromosomes.* Springer-Verlag, Inc. New York. Unpaginated.

Jones, J. K., Carter, D. C., and Genoways, H. H. 1973. Checklist of North American Mammals north of Mexico. *Occasional Papers Museum Tex. Tech. Univ.* 12:1-14.

Kennerly, Thomas E. 1954. Local differentiation in the pocket gopher (*Geomys personatus*) in southern Texas. *Tex. Jour. Sci.,* 7:297-329.

Patton, R. F. 1974. *Ecological and Behavorial Relationships of the Skunks of Trans-Pecos Texas.* Unpublished Ph.D. Dissertation, Texas A&M Univ. 198 pp.

Thomas, R. A. 1974. *A checklist of Texas amphibians and reptiles.* Texas Parks and Wildlife Dept., Tech. Series No. 17. 15 pp.

BIRDS OF FALCON, STARR COUNTY, TEXAS

Suzanne Winckler

INTRODUCTION

The Falcon area of Starr County, Texas, is a remnant riparian woodland associated with upland Tamaulipan brush that into the mid-1970s remains relatively undisturbed. Compared to the habitat situation in nearby Hidalgo and Cameron counties, Falcon still hints of the pristine. At one time, these counties shared identical or very similar flora and fauna, largely Mexican in influence. Patches are still preserved at Santa Ana National Wildlife Refuge, Anzalduas, and Bentsen-Rio Grande Valley State Park, but the most extensive contiguous example is now restricted to Falcon. It is this bit of the tropics easing into the United States that makes these woods so special. The significance of the area takes on added import in light of the fact that there is virtually no environmental protection in Mexico, and the Tamaulipan brush in the northeast part of the country is rapidly being cleared off with no regard for its uniqueness.

What does all this mean to students of birds? Simply that if they wish to observe species typical of the Tamaulipan Biotic Province in the best remaining habitat in the United States, they must come to Starr County. Every serious bird watcher has been, or plans someday to come, to Falcon. Falcon's tropicality is underscored by the fact that 21 species of birds whose ranges extend south into Mexico and Central America meet their northeastern limits in extreme South Texas [see boldface birds in checklist]. No other state bordering Mexico–nor Florida with its Caribbean influence–can quite compete with this richness.

The hawk and pigeon families best exemplify this abundance. Twenty-one hawk species have been recorded from the Falcon area, an unusually large number for a temperate-zone locality. This can be explained by the fact that, in addition to the eight neotropical species, both western (e.g., Zone-tailed Hawk) and eastern (e.g., Red-shouldered Hawk) species occur there at least occasionally. It is of note that the eight southern species comprise 39% of the hawks known from the area; the only other places in the United States that might vie with that percentage are southern California, southern Arizona, and southern Florida.

More pigeons and doves occur at Falcon than anywhere else in the United States, and two of them, Red-billed Pigeon and White-fronted Dove, are found only in the Rio Grande Valley of Texas. These two species seek out the tallest and thickest timber available, which is, to repeat, in better supply at Falcon than elsewhere in the Valley.

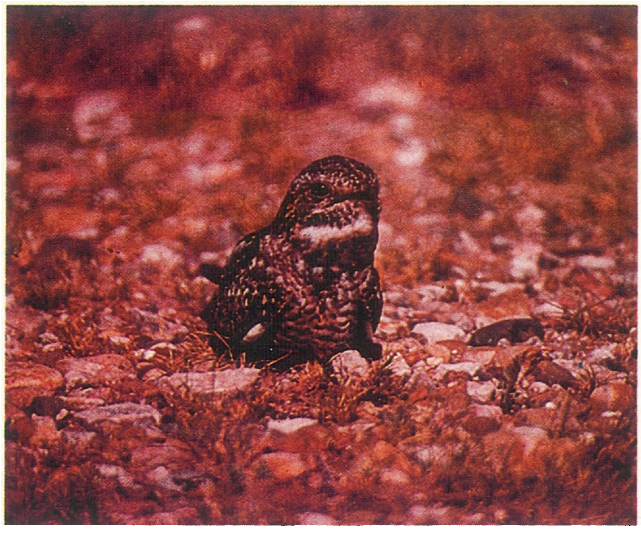
If one bird at Falcon represents the essence of the neotropics it is the long-tailed, chicken-like Chachalaca, the only Cracidae that occurs north of Mexico. Any person who has seen one of its close relatives in the jungles of Latin America can hark back to that memory with one glimpse of wild Chachalacas fumbling and fluttering in the thick river woods at Falcon. And for those who have not birded south of the United States, that same glimpse discloses how exotic the neotropics can be.

A new element of bird life was added to the Falcon area with the first impoundment of the reservoir which began on August 25, 1953. Falcon is one of the southernmost large bodies of fresh water in the United States. Large expanses of water attract migrating and wintering ducks; wandering herons, frigatebirds, and wood storks, and migrating, wintering, and wandering gulls and terns. Several species of farnorthern gulls (see Glaucous Gull, Iceland/Thayer's Gull, and Black-legged Kittiwake in checklist) that have turned up at Falcon would not have done so except for the reservoir. The occurrence of these arctic species makes for a strange and, to the bird watcher, thrilling juncture of the north and the south Falcon has the distinction of being the only place in the Western Hemisphere where, simultaneously in one binocular field, it is possible to see a Black-legged Kittiwake and a Ringed Kingfisher.

It could be said that Falcon is as renowned for the birds that don't get there–but someday may–as for the ones that do. Since the early sixties, the river woods, in particular, have become increasingly well known in birding and ornithological circles. Fairly consistent coverage for the last decade has turned up numerous items of avifaunal interest–the Ringed Kingfisher and Brown Jay being perhaps the most

These birds are specialties of the Falcon area of Starr County, Texas. The river woods and upland brush here remain relatively undisturbed, and for that reason, Falcon is the most promising place north of Mexico to see these birds in the wild. Bird watchers and ornithologists come from all over the United States and Canada to bird in these woods. Photographs by John C. Arvin, McAllen, Texas.

Ferruginous Pygym Owl, *Glaucidium brasilianum*.
Very rare in the river woods.



Lesser Nighthawk, *Chordeiles acutipennis*.
Common in uplands in summer. This bird is incubating eggs on a bare spot on the ground.

Least Grebe, *Podiceps dominicus*.
To be looked for on small ponds.

Brown Jay, *Psilorbinus morio*.
Common, but local, in river woods. Falcon is the only place in the United States where this species occurs.

Black-headed Oriole, *Icterus graduacaudus*.
Uncommon resident of river woods.

Chachalaca, *Ortalis vetula.*
Fairly common in the river woods. Listen for its raucous *slap-her-back!* calls during the breeding season.

White-winged Dove, *Zenaida asiatica.*
Common in summer in river woods.

Green Jay, *Cyanocorax yncas.*
Fairly common resident in river woods.

White-fronted Dove, *Leptotila verreauxi.*
Uncommon resident of river woods.

Lichtenstein's Oriole, *Icterus gularis.*
Fairly common resident of river woods.

Olive Sparrow, *Arremonops refivirgata.*
Fairly common in dense thickets along river.

exciting. Continued coverage of the area, assuming the habitat is undisturbed, will no doubt reveal new and interesting finds. For example, just 50 miles south of Falcon in the Picacho Mountains of Nuevo Leon, Mexico, numerous species of birds—Mottled Wood Owl, Coppery-tailed Trogon, and Rufous-capped Warbler, to name a few—occur at the northeast limits of their range. Range boundaries of birds are exciting to watch over a sustained period because of the element of potential change. Falcon is an excellent harbor for numerous Mexican species, including all those mentioned above, and the possibility of such events should be kept in mind when the area is surveyed. Falcon offers much in the realm of surprises.

METHODS

Edgar B. Kincaid, Jr., and I surveyed the Falcon area on two different occasions during the summer of 1975 (July 21-23 and August 23-25); on the latter trip we were joined by John C. Arvin of Edinburg, Texas.

We divided our time about equally between upland brush and the river corridor. We covered the uplands by car, driving along river access roads that cut through the dry brush and stopping frequently to record species by sight or sound. We censused the riparian areas on foot, following cattle paths that lead north and south from the access roads where they terminate at the river. The river woods we covered included the Texas ebony-mesquite motte in and near the Tip of Texas Girl Scout camp about one-half mile south of the spillway; Chapeño; Salineño (where the largest stand of Montezuma baldcypress in the U.S. is located); the predominantly willow woods on the Raul Gonzalez property; and Fronton. The boundaries of the area are Falcon State Park on the north, Highway 83 on the east, the Rio Grande where it bends east at Fronton and flows toward Roma on the south, and the Rio Grande on the west. During our two visits we saw 78 species, including 3 (Least Bittern, Baird's Sandpiper, and Black Skimmer) that were first records for the summer season in Starr County.

ACKNOWLEDGMENTS

John C. Arvin was very generous in sharing his thorough knowledge of the Falcon area and in taking us to several birding localities we had not been to before.

ANNOTATED CHECKLIST

This list includes all the birds that occur (or are known to have occurred) at one season or another in the Falcon area. It contains 278 species. I compiled the list from the following sources: *The Bird Life of Texas* (Oberholser 1974); *Birds of Falcon State Park, A Checklist* (John C. Arvin 1974 revised ed.); and eight years of Audubon Christmas Bird Counts (published each year in the Number 2 issue of *American Birds* [formerly *Audubon Field Notes*], Volumes 22-29). Comments under each entry deal primarily with the species' status, season(s) of occurrence, and preferred habitat. Species in boldface type occur in the United States only in the Rio Grande Valley of Texas or, if so stated, only in Starr County, except that two species, Green Kingfisher and Long-billed Thrasher, are not restricted just to the Valley but are found in the United States only in south Texas. Birds marked with an asterisk (*) were observed by Winckler and Kincaid in July and/or August, 1975, while surveying the area for the Texas Natural Areas Survey. A dagger (†) indicates that a species is rare or endangered within its range in the United States. The notation CBC means a species has been censused at least once on an Audubon Christmas Bird Count; see Table 1 (Winter Birds of Falcon) for specific dates and numbers of individuals. Terms of abundance, modified from Oberhosler (1974), are based on the number of individuals of a species one observer is likely to see in the proper habitat and season during a day's bird watching. They are as follows:

Abundant:
more than 500 individuals

Very common:
25 to 500

Common:
10 to 100

Fairly common:
5 to 25 per day or several groups per day; expected but could be missed

Uncommon:
less than 5 per day or no more than 1 group a day; easily missed but expected over several days

Rare (or occasional):
1 or 5 per season or year or 1 group a year or season; very easily missed but expected over several seasons or years. Continued coverage of Falcon may boost the status of some birds from rare, which now is more a comment on lack of daily coverage of the area than a true assessment of the species.

LOONS: GAVIIDAE

Common Loon, *Gavia immer.*

A few individuals occur each winter on the lake. CBC.

GREBES: PODICIPEDIDAE

Eared Grebe, *Podiceps nigricollis.*

Winters, often in good numbers, on the lake and small sewage ponds near spillway. CBC.

†**Least Grebe,** *Podiceps dominicus.*

In recent years John C. Arvin has seen this species at ponds in the Falcon area, particularly at the small sewage ponds located near the spillway. It could very likely nest in the area. This is the first of numerous tropical specialties found only in the Rio Grande Valley. CBC.

Pied-billed Grebe, *Podilymbus podiceps.*

A few individuals can be seen year round on the lake and on small ponds. It could nest in the area, but Oberholser (1974) reports no nesting records. CBC.

CORMORANTS: PHALACROCORACIDAE

Double-crested Cormorant, *Phalacrocorax auritus.*

Winters in the region, where it can be seen about the lake and along the river. CBC.

†***Olivaceous Cormorant,** *Phalacrocorax olivaceus.*

This neotropical species, a year-round resident of Falcon, has been sinking precariously as a nester in Texas. Judging from summertime numbers on the lake and along the river, the Falcon area may serve as a last stronghold in the U.S. (e.g., a total of 165 were observed in the vicinity of the spillway on July 23, 1975). CBC.

ANHINGAS: ANHINGIDAE

*Anhinga, *Anhinga anhinga.*

This stately bird of the Deep South is an occasional spring and fall migrant as far west as Starr County. Kincaid, Arvin, and I saw a flock of about 70 at the Tip of Texas Girl Scout Camp on August 24, 1975.

FRIGATE-BIRDS: FREGATIDAE

Magnificent Frigate-bird, *Fregata magnificens.*

Oberholser (1974) lists one fall record for Starr County. Inland occurrences of this species are usually associated with storms. It would not be surprising to see it at Falcon during post-hurricane watches.

HERONS, EGRETS, BITTERNS: ARDEIDAE

(Members of this family are noted postnuptial wanderers, chiefly during the months of July, August, and September; hence, summer sightings can never be used as evidence of nesting. Unless mention is made otherwise, herons and egrets are seen most frequently on sandbars along the river or flying to or from their roosts in morning or evening.)

Great Blue Heron, *Ardea herodias.*

Winters in good numbers. Occurs in fewer numbers throughout the year, but nesting has not been recorded. CBC.

*Green Heron, *Butorides virescens.*

Uncommon migrant and summer visitor. Nesting is questionable. One CBC individual (December 27, 1972) could have been a lingering migrant, rather than an over-wintering bird.

Little Blue Heron, *Florida caerulea.*

Occasional visitor in spring, summer, and fall. Oberholser (1974) shows a winter record, but species has not been recorded on CBC.

Cattle Egret, *Bubulcus ibis.*

This famous African invader can now be seen throughout the year in the Falcon area in the proper habitat—around the feet of cattle. Hence, it is seen in uplands as a rule, unlike herons in general. Oberholser (1974) shows no nesting record. CBC.

Reddish Egret, *Dichromanassa rufescens.*

This Gulf coast heron very occasionally wanders upriver to Starr County.

*Great (Common) Egret, *Casmerodius albus.*

Rare migrant and summer and winter visitor. CBC.

*Snowy Egret, *Egretta thula.*

Uncommon and irregular migrant and summer and winter visitor, some winters occurring in good numbers. CBC.

Louisiana Heron, *Hydranassa tricolor.*

Apparently an occasional postnuptial visitor. One CBC record.

Black-crowned Night Heron, *Nycticorax nycticorax.*

This and the following species are nocturnal in habit and therefore difficult to census during the day. This species is apparently present at all seasons in small numbers, but nesting has not been reported. One CBC record.

Yellow-crowned Night Heron, *Nyctanassa violacea.*

See above species; same status applies.

*Least Bittern, *Ixobrychus exilis.*

Another reclusive bird whose movements are little known. Kincaid and I observed one at the cattail marsh just east of the Girl Scout camp about 8:15 p.m. on July 21, 1975, which appears to be a new spring record for Starr County. Arvin (personal communication) thinks it could possibly nest in the marsh.

STORKS: CICONIIDAE

Wood Stork, *Mycteria americana.*

Arvin (1974) lists it as an occasional postnuptial wanderer to the region.

GEESE AND DUCKS: ANATIDAE

(The largest concentrations of migrating and wintering ducks will usually be seen on the lake or on the river just below the spillway. Small groups also occur on the sewage ponds, and scattered individuals or small groups are seen along the river.

Notes regarding other habitat preferences are made under the species.)

Canada Goose, *Branta canadensis.*
Arvin (1974) lists as an occasional fall migrant.

White-fronted Goose, *Anser albifrons.*
Occasional fall migrant and winter visitor. Two CBC records.

Black-bellied Tree Duck, *Dendrocygna autumnalis.*
Numbers of this local and erratic neotropical duck fluctuate for reasons not well understood. At least formerly it has nested in the vicinity of Falcon; whether it has recently is open to question.

Mallard, *Anas platyrhynchos.*
Arvin (1974) lists as an occasional winter visitor.

Gadwall, *Anas strepera.*
Uncommon to common winter visitor. CBC.

Pintail, *Anas acuta.*
Uncommon to common winter visitor. CBC.

Green-winged Teal, *Anas carolinensis.*
Uncommon to fairly common winter visitor. CBC.

Blue-winged Teal, *Anas discors.*
Common migrant, but apparently birds seldom overwinter. One CBC record.

Cinnamon Teal, *Anas cyanoptera.*
The least common and most handsome of the teals. An occasional winter visitor. Two CBC records.

Shoveler, *Anas clypeata*
Probably a fairly common migrant; uncommon and irregular in winter. CBC.

American Wigeon, *Mareca americana.*
Uncommon to fairly common winter visitor. CBC.

Wood Duck, *Aix sponsa.*
This elegant duck of the eastern U.S. very occasionally winters at Falcon. If and when encountered, it almost surely would be on the river or up one of the draws, rather than on the lake. One CBC record.

Redhead, *Aythya americana.*
Occasional winter visitor. One CBC record.

Ring-necked Duck, *Aythya collaris.*
Occasional winter visitor. Two CBC records.

Canvasback, *Aythya valisineria.*
Occasional winter visitor. CBC.

Greater Scaup, *Aythya marila.*
This species is not to be expected. Because it is difficult to distinguish in the field from the Lesser (see next species), records should be eyed with skepticism. One CBC record.

Lesser Scaup, *Aythya affinis.*
Generally fairly common to common winter visitor but absent some winters. CBC.

Bufflehead, *Bucephala albeola.*
Uncommon to fairly common some winters; absent others. To be seen on the lake, not the river. CBC.

Ruddy Duck, *Oxyura jamaicensis.*
Fairly common to common migrant; uncommon to fairly common some winters, but absent others. To be expected on the lake instead of the river. CBC.

Red-breasted Merganser, *Mergus serrator.*
Occasional winter visitor, probably never more than a few individuals during a season. CBC.

AMERICAN VULTURES: CATHARTIDAE

*Turkey Vulture, *Cathartes aura.*
Common resident. CBC.

*Black Vulture, *Coragyps atratus.*
Slightly less common than the Turkey Vulture. There is a particularly large vulture roost near Arroyo Minita where large concentrations of vultures can be seen early in the morning or in the evening. They can be seen from a high bluff overlooking the river about three miles south of Raul Gonzalez's house. CBC.

HAWKS: ACCIPITRIDAE

(The eight neotropical species are noted here and under Falconidae with a double dagger ††.)

†White-tailed Kite, *Elanus leucurus.*
This species formerly bred in Starr County (eggs collected, May 26, 1903) but about the turn of the century withdrew from the area, remaining as a nester only in Hidalgo and Cameron counties. However, this kite has been exhibiting an impressive increase throughout its U.S. range during the last decade (see E. Eisemann 1971, *American Birds* 25:529-536) and will possibly recolonize the drier upland portions of the Falcon area. Arvin (personal communication) has seen scattered individuals recently, and there is one CBC record.

*Mississippi Kite, *Ictinia misisippiensis.*
Uncommon migrant. On August 23, 1975, while standing on the river bluff overlooking Arroyo Minita (see Black Vulture), Kincaid, Arvin, and I saw a flock of about 100 birds circling over the river.

Sharp-shinned Hawk, *Accipiter striatus.*
The status of accipiters is difficult to assess because they are reclusive woodland birds. The Sharpshin is probably a rare to uncommon migrant and winter visitor. CBC.

Cooper's Hawk, *Accipiter cooperii.*
Status for Sharpshin (see above) applies. CBC.

*Red-tailed Hawk, *Buteo jamaicensis.*
Rather uncommon migrant and winter visitor. Oberholser (1974) shows a nesting record for Starr County, but Arvin (1974) does not list it as a nester, which supports reports of recent decline of this species as a breeder in the south Texas brush country. In the Falcon area, it occurs in upland brush and is most likely to be seen soaring or perched on a utility pole. CBC.

Red-shouldered Hawk, *Buteo lineatus.*
Probably only a rare visitor from the wooded eastern portion of the state. One CBC record.

Broad-winged Hawk, *Buteo platypterus.*
Common spring and fall migrant. One CBC record.

*Swainson's Hawk, *Buteo swainsoni.*
Common spring and fall migrant, apparently nesting some years (Arvin, personal communication).

†Zone-tailed Hawk, *Buteo albonotatus.*
This buteo of the neotropics and the rugged western U.S. can be mistaken for a Turkey Vulture. It is an occasional and unpredictable visitor to the Falcon area. The most recent sightings are one on July 2, 1971, and two on December 22, 1974.

†White-tailed Hawk, *Buteo albicaudatus.*
In Texas this hawk frequents coastal grassland and adjacent inland mesquite-live oak brush, from where individuals occasionally wander to Falcon, apparently at any season. Wanderers would be observed in the uplands, not along the river.

††Gray Hawk, *Buteo nitidus.*
The northern range of this neotropical hawk gives out along the U.S.-Mexico border. Arvin (personal communication) reports individuals at all seasons in the Falcon area; however, nesting evidence is lacking for Starr County. It seeks mature river woods and nearby brushy scrublands typical of Falcon. Two CBC records.

†*Harris Hawk, *Parabuteo unicinctus.*
The common hawk of Falcon. Mesquite-pricklypear woodlands are prime habitat for it. This species may be declining in south Texas; its numbers should be carefully watched. CBC.

††Black Hawk, *Buteogallus anthracinus.*
This neotropical hawk frequents riparian woods and prior to 1940 nested along the Rio Grande in Starr, Hidalgo, and Cameron counties. It has retreated from the Rio Grande Valley, but individuals may still wander into the region. The first report in recent decades was an individual seen at the spillway by Kincaid and me on May 18, 1975; after observing it for about three minutes, we watched a Harris Hawk chase it downriver and back into Mexico.

Marsh Hawk, *Circus cyaneus.*
Rather uncommon migrant and winter visitor, to be expected in upland brush and cultivated fields. CBC.

OSPREY: PANDIONIDAE

†*Osprey, *Pandion haliaetus.*
Uncommon winter visitor and seasonal wanderer. This fish-eating cosmopolitan species may turn up anywhere there is a large open body of water. The reservoir has undoubtedly boosted the number of Ospreys in the Falcon area. CBC.

CARACARAS AND FALCONS: FALCONIDAE

†Caracara, *Caracara cheriway.*
This species occurs in coastal grasslands and higher portions of the south Texas brush country. Occasional individuals wander into the upland brush of Falcon.

Prairie Falcon, *Falco mexicanus.*
Rare winter visitor.

†Peregrine Falcon, *Falco peregrinus.*
Very rare migrant and winter visitor. One CBC record.

†Aplomado Falcon, *Falco femoralis.*
A neotropical hawk whose range extends from the U.S.-Mexico border to Tierra del Fuego. It favors arid, grassy uplands. Prior to 1910, this falcon nested in southwestern Texas from El Paso to Brownsville; it is now virtually extirpated as a breeder but an individual is occasionally reported within its historic range in Texas. It should be looked for at Falcon.

Merlin (Pigeon Hawk), *Falco columbarius.*
Rare migrant and winter visitor. Two CBC records.

Kestrel (Sparrow Hawk), *Falco sparverius.*
Common migrant and winter visitor. CBC.

GUANS AND CHACHALACAS: CRACIDAE

***Chachalaca,** *Ortalis vetula.*
Uncommon to fairly common resident in the riparian woods. The thick woods in and near the Girl Scout camp are the best place in the U.S. to see *wild* Chachalacas (the birds at Santa Ana National Wildlife Refuge have been hand-fed for so long they are not unlike barnyard chickens). During the last five years, *O. vetula* seems to be increasing in the Falcon area; as long as these woods are not disturbed, Falcon should continue to be crucial in maintaining the species' U.S. population. CBC.

QUAILS, PHEASANTS: PHASIANIDAE

*Bobwhite, *Colinus virginianus.*
Common resident, primarily in upland areas wherever there is adequate grassy, woody, and herbaceous cover. CBC.

*Scaled Quail, *Callipepla squamata.*
Common resident in upland areas where there is good ground cover. CBC.

CRANES: GRUIDAE

Sandhill Crane, *Grus canadensis.*
Apparently an occasional winter visitor. One CBC record.

RAILS, GALLINULES, COOTS: RALLIDAE

Sora, *Porzana carolina.*
Uncommon migrant and winter visitor in small cattail ponds or emergent vegetation along the river. CBC.

Common Gallinule, *Gallinula chloropus.*
Uncommon at all seasons in same habitat as Sora (see above); could nest but no specific evidence available. CBC.

American Coot, *Fulica americana.*
Common migrant; abundant in winter; uncommon during summer (may nest some years in cattail ponds or emergent vegetation along river or lake). Large flocks

concentrate on the lake, scattered individuals along the river. CBC.

PLOVERS: CHARADRIIDAE

*Snowy Plover, *Charadrius alexandrinus.*
Apparently an occasional migrant or postnuptial wanderer to be expected on bare lake shore, river sandbars, or the spillway. Kincaid, Arvin, and I saw a flock of 4 on August 24 and 25, 1975, in the state park.

*Killdeer, *Charadrius vociferus.*
Common resident of upland brush, pastures, cowlots, and similar open areas. Avoids river woods but can be seen on sandbars along the river and on the spillway. CBC.

Black-bellied Plover, *Pluvialis squatarola.*
Rare migrant and winter visitor. One CBC record.

WOODCOCK, SNIPE, SANDPIPERS: SCOLOPACIDAE

Woodcock, *Philohela minor.*
Very rare winter visitor, which, when present, occurs in thick undercover of the river woods. One CBC record.

Common Snipe, *Capella gallinago.*
Uncommon in winter, confined to thick vegetation, usually in association with a pond. CBC.

Long-billed Curlew, *Numenius americanus.*
Occasional migrant and winter visitor to be expected in upland areas, pastures, and fields. One CBC Record.

*Upland Sandpiper, *Bartramia longicauda.*
Uncommon to fairly common migrant, occurring in upland areas, pastures, and fields. This species is a nocturnal migrant, and the usual way to detect its presence is to listen for its calls as it flies overhead at night.

*Spotted Sandpiper, *Actitis macularia.*
Fairly common migrant and winter visitor, most frequently encountered on sandbars or flying low over the river. CBC.

*Solitary Sandpiper, *Tringa solitaria.*
Uncommon migrant; rare in winter. One CBC record.

Greater Yellowlegs, *Tringa melanoleuca.*
Uncommon migrant and winter visitor to be expected on sandbars, the spillway, and at sewage ponds. CBC.

*Lesser Yellowlegs, *Tringa flavipes.*
Fairly common to common migrant and winter visitor. Habitat same as for Greater (see above). CBC.

Pectoral Sandpiper, *Calidris melanotos.*
Uncommon migrant that could occur along the river and lake as well as in drier upland situations.

*Baird's Sandpiper, *Calidris bairdii.*
Apparently an occasional migrant. One bird observed July 23, 1975, by Kincaid and me on the spillway represents a new record for Starr County. Probably small numbers pass through each season unobserved. It should be looked for on sandbars along the river, on the spillway, edges of sewage ponds, and in drier upland areas.

*Least Sandpiper, *Calidris minutilla.*
Fairly common migrant and winter visitor occurring on sandbars, the spillway, bare lake shore, etc. CBC.

Semipalmated Sandpiper, *Calidris pusillus.*
Rare migrant and winter visitor, although winter records should be accepted with caution since this species is very difficult to distinguish in the field from the following species. One CBC record.

*Western Sandpiper, *Calidris mauri.*
Uncommon migrant and winter visitor. CBC.

Dowitcher, *Limnodromus* sp.
Occasional migrant.

AVOCETS AND STILTS: RECURVIROSTRIDAE

American Avocet, *Recurvirostra americana.*
Occasional migrant seen on river sandbars, the spillway, sewage ponds, on bare lake shores.

Black-necked Stilt, *Himantopus mexicanus.*
Status and habitat same as Avocet (see above).

PHALAROPES: PHALAROPODIDAE

Wilson's Phalarope, *Steganopus tricolor.*
Occasional migrant, probably more likely to occur on the lake than on the river.

GULLS AND TERNS: LARIDAE

(Unless otherwise noted, larids predictably occur on the lake and around the spillway.)

Glaucous Gull, *Larus hyperboreus.*
The individual observed December 28 and 29, 1971, at the spillway by Kincaid, et al., apparently represents the southernmost sighting ever recorded of this high arctic species.

Iceland or Thayer's Gull, *Larus glaucoides* or *thayeri.*
There was some dispute over the true identity of a *Larus* gull seen December 29, 1971, at the spillway (for details see Oberholser 1974:379-380). Both *glaucoides* and *thayeri* are high arctic species, and the Falcon sighting represents a southernmost record for either species.

Herring Gull, *Larus argentatus.*
Uncommon and irregular in winter. CBC.

Ring-billed Gull, *Larus delawarensis.*
Fairly common to common in winter. Often seen flying up and down the river. CBC.

Laughing Gull, *Larus atricilla.*
Rare winter visitor; occasional postnuptial wanderer from Gulf coast. CBC.

Franklin's Gull, *Larus pipixcan.*
Very common migrant. This is the one gull apt to be seen in dry upland situations, especially fields.

Bonaparte's Gull, *Larus philadelphia.*
Occasional winter visitor. Two CBC records.

Black-legged Kittiwake, *Rissa tridactyla.*
Another arctic species that is largely pelagic in winter. It has occurred at least twice at Falcon: December 29,

1971 (Kincaid et al.) and January 25, 1975 (Frances Williams, personal communication).

Forster's Tern, *Sterna forsteri.*
Rare in winter. One CBC record.

*Least Tern, *Sterna albifrons.*
Uncommon migrant; also occurs in summer (but nesting unlikely). Kincaid, Arvin, and I observed a flock of six on August 15, 1975, at the boat landing in the park. Migrants also perch on river sandbars.

Caspian Tern, *Hydroprogne caspia.*
Occasional migrant.

*Black Tern, *Chlidonias niger.*
Uncommon migrant.

SKIMMERS: RYNCHOPIDAE

*Black Skimmer, *Rynchops nigra.*
Apparently an occasional postnuptial wanderer from the coast. Six birds (three adults and three immatures) were found by Arvin at the boat landing in the park on August 25, 1975; this observation represents a new record for Starr County.

PIGEONS AND DOVES: COLUMBIDAE

†***Red-billed Pigeon,** *Columba flavirostris.*
Rare, formerly fairly common, resident in the river woods; fewer in winter. This bird is becoming a scarce item in the Valley, as well as throughout Mexico, largely because of habitat destruction (see Oberholser 1974:412 for an account of its decline). During the survey Kincaid and I saw or heard, on the average, four individuals a day. Two CBC records.

*White-winged Dove, *Zenaida asiatica.*
One of the most numerous nesting birds in Falcon's river woods; withdraws in winter. The Whitewing's husky *coo-uh-cuck-oo* calls are a conspicuous part of Falcon in summer. Judging from our censuses in July and August 1975, the species is currently in good numbers in the area.

*Mourning Dove, *Zenaida macroura.*
Abundant resident, occurring in a variety of habitats from the river woods to upland brush and agricultural areas. CBC.

*Ground Dove, *Columbina passerina.*
Fairly common resident, primarily of upland brush. CBC.

*Inca Dove, *Scardafella inca.*
Fairly common resident, occurring most often around human habitations—yards, gardens, livestock yards—and along country lanes. CBC.

†***White-fronted Dove,** *Leptotila verreauxi.*
Uncommon resident of the river woods; somewhat more numerous than the Red-billed Pigeon. This species is the northernmost-ranging *Leptotila,* a genus whose members occur throughout the jungles of the Americas. CBC.

CUCKOOS: CUCULIDAE

*Yellow-billed Cuckoo, *Coccyzus americanus.*
Common but reclusive summer resident of the river woods, whose hollow *ka ka ka kow kowlp* calls are more often heard than the bird is seen.

*Roadrunner, *Geococcyx californianus.*
This terrestrial cuckoo is a common resident, most frequently seen in brushy uplands. CBC.

***Groove-billed Ani,** *Crotophaga sulcirostris.*
This odd neotropical bird with the Roman nose beak is another Falcon specialty. Fairly common summer resident of thick brush, most often seen along or near the river; a few linger all winter during mild years. Judging by the numbers seen in July and August the species had a good nesting season in 1975. Two CBC records.

BARN OWLS: TYTONIDAE

Barn Owl, *Tyto alba.*
Uncommon to rare resident, probably roosting in tree- and brush-lined arroyos, river woods, and abandoned outbuildings. CBC.

TYPICAL OWLS: STRIGIDAE

*Screech Owl, *Otus asio.*
Uncommon resident of the river woods. CBC.

*Great Horned Owl, *Bubo virginianus.*
Uncommon resident (probably some withdrawal in cold winters). Inhabits both the river woods and upland brush but is more numerous in the latter area. CBC.

Ferruginous Pygmy Owl, *Glaucidium brasilianum.*
Very rare in the river woods. Arvin saw and photographed an individual July 20, 1975—the most recent report of the species at Falcon. The species' decline in Texas coincides with the clearing of brush in the Rio Grande Valley; Falcon remains one of the best remaining habitats north of Mexico for this neotropical owl.

Elf Owl, *Micrathene whitneyi.*
Probably a former summer resident of the area. The closest nesting population, and probably the largest in Texas, is in extreme southeast Starr County near La Grulla (about 30 miles from Falcon). Here the birds nest along a railroad track in telephone pole holes. It is conceivable that individuals from this stock could move upriver and repopulate the Falcon area.

Burrowing Owl, *Speotyto cunicularia.*
Apparently a rare and irregular winter visitor to be looked for in upland areas. Oberholser (1974) lists a fall and winter specimen from Starr County.

GOATSUCKERS: CAPRIMULGIDAE

(Members of this family are largely nocturnal or crepuscular and are more often heard than seen.)

Chuck-will's-widow, *Caprimulgus carolinensis.*
Uncommon migrant. Kincaid heard one calling from upland brush in the state park on May 17, 1975, an unusually late date for a migrant.

Poorwill, *Phalaenoptilus nuttalli.*
A bird of dry uplands. Arvin (1974) lists this species as a common summer resident. We did not hear any during July and August, probably because it was late in the season and birds had either migrated or stopped calling.

*Pauraque, *Nyctidromus albicollis.*
The *pur-pur-pur-wheeeeeerrrrs* of this bird are the most distinctive sound of summer nights at Falcon. Fairly common resident (fewer in winter) of the river woods and nearby upland brush. The best way to see Pauraques is to drive the dirt roads at night. Car headlights easily pick up the glowing pink eyeshine of birds sitting in the road. CBC.

*Lesser Nighthawk, *Chordeiles acutipennis.*
Common summer resident favoring open upland brush. Its presence is best determined by its hollow catlike purrs as it flies about at dusk and at night. CBC.

SWIFTS: APODIDAE

Chimney Swift, *Chaetura pelagica.*
Fairly common migrant.

HUMMINGBIRDS: TROCHILIDAE

*(?)Ruby-throated Hummingbird, *Archilochus colubris.*
Uncommon to fairly common migrant to be looked for around flowering shrubs along the river. Occasionally individuals linger during mild winters. (Hummingbirds observed during July and August 1975 were either this species or Blackchins.)

Black-chinned Hummingbird, *Archilochus alexandri.*
Uncommon to fairly common migrant; nests rarely, according to Oberholser (1974) and Arvin (1974), probably in trees along the river or in nearby upland brush.

Broad-tailed Hummingbird, *Selasphorus platycercus.*
Oberholser (1974) lists as a rare migrant at Falcon Reservoir.

Rufous Hummingbird, *Selasphorus rufus.*
Probably occurs very rarely in winter. One sight record in Oberholser (1974).

Buff-bellied Hummingbird, *Amazilia yucatanensis.*
One winter record: one seen in the river woods on December 28, 1971, by G. Frank Oatman.

TROGONS: TROGONIDAE

Coppery-tailed Trogon, *Trogon elegans.*
A neotropical bird which currently nests in the U.S. only in southeastern Arizona. Two specimens were collected but not preserved in Starr County in 1877 (see Oberholser 1974:499). Recently the Coppery-tailed has been found breeding in the Picacho Mountains in Mexico about 50 miles south of Falcon (Rose Ann Rowlett, personal communication). If it were to reinhabit Texas, Falcon would be the likely place.

KINGFISHERS: ALCEDINIDAE

*Belted Kingfisher, *Megaceryle alcyon.*
Fairly common migrant in winter, chiefly along the river. CBC.

***Ringed Kingfisher,** *Megaceryle torquata.*
Fairly common resident along the river. If there is one bird for which Falcon is famous it is the Ringed Kingfisher—largest kingfisher of the Americas. A male of the species was first discovered by Kincaid and John L. Rowlett on March 2, 1966; breeding was confirmed by Dan McGrew April 8, 1970 (see Oberholser 1974:503 for details). Kincaid speculates that the Ringed Kingfisher favors the Falcon area because the nearby dam retains silt, thereby making the river below the spillway relatively clear—the better for the bird to see its prey. Also the river banks here are high enough to provide nest holes. CBC.

***Green Kingfisher,** *Chloroceryle americana.*
Fairly common in winter; breeding along river suspected, but unconfirmed. CBC.

WOODPECKERS: PICIDAE

Yellow-shafted Flicker, *Colaptes auratus.*
Rare some winters, absent others, in the river woods. CBC.

Red-shafted Flicker, *Colaptes cafer.*
Very rare winter visitor. One CBC record.

*Golden-fronted Woodpecker, *Centurus aurifrons.*
Common resident of river woods and dry uplands. CBC.

Yellow-bellied Sapsucker, *Sphyrapicus varius.*
Rare but fairly regular winter visitor in river woods. CBC.

*Ladder-backed Woodpecker, *Dendrocopos villosus.*
Common resident of river woods and dry uplands. CBC.

COTINGAS: COTINGIDAE

Rose-throated Becard, *Platypsaris aglaiae.*
The usual place to see this bird in the U.S. is in southeastern Arizona. The Rio Grande Valley is the only other U.S. locality where it occurs at least irregularly. It has been recorded in summer in Starr County, and Arvin has seen old nests in the Falcon river woods (personal communication); it nests with some regularity at Santa Ana National Wildlife Refuge and Anzalduas in nearby Hidalgo County. The Falcon area is one of the last stands in the Valley where the species might be expected.

TYRANT FLYCATCHERS: TYRANNIDAE

Eastern Kingbird, *Tyrannus tyrannus.*
Apparently a rather rare migrant.

*Tropical Kingbird, *Tyrannus melancholicus.*
Common summer resident, primarily of the river woods, but also occurs in upland mesquite. A few linger during mild winters. CBC.

Western Kingbird, *Tyrannus verticalis.*
Uncommon migrant, which Kincaid and I observed at Falcon in May of this year, but not in July or August. In recent years (fifties and sixties) this western flycatcher—a bird of open country with scattered trees—has been moving east and south in Texas with the clearing of the mesquite. It has been recorded in summer in Starr County and has nested in Hidalgo, so it would not be surprising to find nesting evidence in the uplands.

*Scissor-tailed Flycatcher, *Muscivora forficata.*
Very common summer resident, typically encountered in upland brush.

***Kiskadee Flycatcher,** *Pitangus sulphuratus.*
This robust yellow-bellied flycatcher is a fairly common and conspicuous resident of the river woods; perhaps a few withdraw in cold winters. CBC.

Sulphur-bellied Flycatcher, *Myiodynastes luteiventris.*
A neotropical species whose range plays out at the U.S.-Mexico border. No specimen for Texas but several plausible records. The most recent: several seen on the Raul Gonzalez property by Arvin on July 19, 1975.

Great Crested Flycatcher, *Myiarchus crinitus.*
Apparently a rare spring migrant (Arvin 1974, Oberholser 1974).

*Wied's Crested Flycatcher, *Myiarchus tyrannulus.*
Fairly common summer resident of the river woods; withdraws in winter.

*Ash-throated Flycatcher, *Myiarchus cinerascens.*
The uplands counterpart of the Wied's. Uncommon summer resident of dry mesquite brush; withdraws in winter.

Eastern Phoebe, *Sayornis phoebe.*
Fairly common winter visitor that most frequently occurs along the river. CBC.

Black Phoebe, *Sayornis nigricans.*
Decidedly irregular and rare winter visitor along the river (Arvin 1974, Oberholser 1974); as yet not recorded on a CBC.

Say's Phoebe, *Sayornis sayus.*
Uncommon winter visitor which is typically seen in the mesquite uplands. CBC.

Empidonax sp.
Empidonax flycatchers are very difficult to identify in the field, especially during the nonbreeding season when they are not vocalizing. Oberholser (1974) records spring specimens for the Yellow-bellied Flycatcher, *E. flaviventris,* and the Least, *E. minimus.* Taken collectively, *Empidonaces* are uncommon migrants and occasional winter visitors at Falcon. CBC.

Eastern Wood Pewee, *Contopus virens.*
Apparently a rare migrant (Oberholser 1974). Arvin merely lists the genus *Contopus* on the assumption that the Western, *C. sordidulus,* may occasionally pass through also. *Virens* would be more likely along the river; *sordidulus* in the dry uplands.

Olive-sided Flycatcher, *Nuttallornis borealis.*
Uncommon migrant, probably encountered more often in the dry uplands.

Vermilion Flycatcher, *Pyrocephalus rubinus.*
Rather uncommon winter visitor in mesquite, usually not far removed from water; most numerous in the state park where the uplands meet the lake. CBC.

Beardless Flycatcher, *Camptostoma imberbe.*
Oberholser (1974) records a spring sight record for this species, which at least formerly nested in the Rio Grande Valley. (The only other place in the U.S. it now occurs with any regularity is southeastern Arizona.)

LARKS: ALAUDIDAE

Horned Lark, *Eremophila alpestris.*
Apparently a rare migrant that would occur in open upland areas. One CBC record.

SWALLOWS: HIRUNDINIDAE

(Birds of this family when migrating are most often seen on the wing or lined up on a utility wire.)

Tree Swallow, *Iridoprocne bicolor.*
Uncommon migrant; occasional in winter.

Bank Swallow, *Riparia riparia.*
Common summer resident which utilizes banks of river bluffs or arroyos for nest sites; also a common migrant.

*Rough-winged Swallow, *Stelgidopteryx ruficollis.*
Common migrant; occasional in winter and summer (nesting unconfirmed). CBC.

Barn Swallow, *Hirundo rustica.*
Abundant migrant. One CBC record.

*Cliff Swallow, *Petrochelidon pyrrhonota.*
Common migrant, occurring throughout the summer. Requires bluffs and cliffs for nest sites; conceivably breeds along the river.

Purple Martin, *Progne subis.*
Rare migrant; formerly (1891, last report) nested.

JAYS AND CROWS: CORVIDAE

Blue Jay, *Cyanocitta cristata.*
Occasionally an individual reaches Starr County, probably during harsh winters; in any case, a freakish event.

***Brown Jay,** *Psilorhinus morio.*
This species has lately increased Falcon's fame in terms of birds. It is not unusual to encounter bird watchers from such faraway places as Canada who have come to Falcon expressly to see *Psilorhinus morio.* A bird of lowland Mexico and Central America, it was discovered nesting at Falcon in the river woods in the summer of 1974. Arvin (personal communication) as recently as November 8, 1975, recorded 57 individuals sighted along the river. Two things in particular will be interesting to watch: (1) whether the population stabilizes as the Ringed Kingfisher has done; and (2) whether the

Brown Jays affect the resident population of Green Jays. CBC.

*Green Jay, *Cyanocorax yncas.*
This bright green, yellow, black, and blue jay is Falcon's most flamboyant bird. It is a fairly common resident restricted to the river woods. CBC.

*White-necked Raven, *Corvus cryptoleucus.*
Fairly common resident of upland areas. Individuals can usually be seen scavenging at the municipal dump on the outskirts of nearby Roma. CBC.

TITMICE, VERDIN: PARIDAE

*Black-crested Titmouse, *Parus atricristatos.*
Common resident in trees and brush either along the river or in adjacent uplands. CBC.

*Verdin, *Auriparus flaviceps.*
Common resident of mesquite uplands and brushy arroyos that cut into the river. Not present—or difficult to see—during cold winters. CBC.

NUTHATCHES: SITTIDAE

Red-breasted Nuthatch, *Sitta canadensis.*
Occasional winter visitor to be expected in trees along the river; as yet not recorded on CBC.

CREEPERS: CERTHIIDAE

Brown Creeper, *Certhia familiaris.*
Rare in winter in river woods. Two CBC records.

WRENS: TROGLODYTIDAE

House Wren, *Troglodytes aedon.*
Fairly common to common migrant and winter visitor along the river and in upland brush. CBC.

Winter Wren, *Troglodytes troglodytes.*
Rather rare and irregular winter visitor that secludes itself in thick underbrush. CBC.

*Bewick's Wren, *Thryomanes bewickii.*
Common resident in thickets near or removed from water. CBC.

Carolina Wren, *Thryothorus ludovicianus.*
Rare in winter. The Lomita race, *T. l. lomitensis,* which probably formerly nested at Falcon, appears to be largely extirpated from the entire Rio Grande Valley. Two CBC records.

*Cactus Wren, *Campylorhynchus brunneicapillus.*
Common resident of upland areas. CBC.

Long-billed Marsh Wren, *Telmatodytes palustris.*
Uncommon winter visitor to be looked for in cattail marshes and emergent vegetation around ponds. CBC.

Short-billed Marsh Wren, *Cistothorus platensis.*
Rare in winter in same type of situations that Long-billed frequents. One CBC record.

Rock Wren, *Salpinctes obsoletus.*
Rather rare resident that sometimes goes unobserved. It frequents rocky uplands and arroyos and the man-made riprap embankments of the spillway. CBC.

MOCKINGBIRDS AND TRASHERS: MIMIDAE

*Mockingbird, *Mimus polyglottos.*
Very common resident, occurring everywhere but in the thickest river brush and the most overcut uplands. CBC.

Catbird, *Dumetella carolinensis.*
Rare migrant and winter visitor that seeks thick underbrush. One CBC record.

*Long-billed Thrasher, *Toxostoma longirostre.*
Fairly common resident, favoring riverside trees and thickets. CBC.

*Curve-billed Thrasher, *Toxostoma curvirostre.*
Fairly common resident, favoring dry uplands. CBC.

Sage Thrasher, *Oreoscoptes montanus.*
Rare migrant and winter visitor to be expected in uplands. Two CBC records.

THRUSHES: TURDIDAE

Robin, *Turdus migratorius.*
Irregularly uncommon to fairly common in winter. CBC.

Hermit Thrush, *Hylocichla guttata.*
Uncommon in winter in riverside thickets. CBC.

Swainson's Thrush, *Hylocichla ustulata.*
Uncommon migrant, restricted chiefly to river woods.

Eastern Bluebird, *Sialia sialis.*
Rare winter visitor. Two CBC records.

GNATCATCHERS AND KINGLETS: SYLVIIDAE

Blue-gray Gnatcatcher, *Polioptila caerula.*
Common in winter, largest numbers occurring along the river. CBC.

Black-tailed Gnatcatcher, *Polioptila melanura.*
Rare winter visitor in dry uplands. Formerly (nineteenth century) it probably nested in the arroyos of the Rio Grande (Oberholser 1974). Two CBC records.

Golden-crowned Kinglet, *Regulus satrapa.*
Rather rare and irregular winter visitor. CBC.

Ruby-crowned Kinglet, *Regulus calendula.*
Common in migration and winter, the largest number occurring along the river but also found along fence rows, in fallow fields, and in trees around houses. CBC.

PIPITS: MOTACILLIDAE

Water Pipit, *Anthus spinoletta.*
Uncommon to fairly common in winter, seen mainly in open, dry areas. CBC.

Sprague's Pipit, *Anthus spragueii.*
Rare in winter in dry, open situations where grass is short. One CBC record.

WAXWINGS: BOMBYCILLIDAE

Cedar Waxwing, *Bombycilla cedrorum.*
Usually very common in winter, but its occurrence is erratic—flocks may appear anytime from November to late May. Birds move in roving bands wherever sufficient supplies of berries can be found. CBC.

SHRIKES: LANIIDAE

Loggerhead Shrike, *Lanius ludovicianus.*
Fairly common in winter. Individuals are usually seen perched atop a bare tree or on a utility wire. CBC.

STARLINGS: STURNIDAE

Starling, *Sturnus vulgaris.*
This Old World species (first released in the U.S. in New York City in 1890) moved into the Rio Grande Valley as a winter visitor in the late 1930s. At Falcon it frequents places of human habitation (rather than the river woods or undisturbed upland areas) and is still rare in winter; however, it will probably continue to invade and will undoubtedly nest in the region in the future, at least irregularly. One CBC record.

VIREOS: VIREONIDAE

*White-eyed Vireo, *Vireo griseus.*
Fairly common summer resident of riverside thickets; uncommon in winter. CBC.

Bell's Vireo, *Vireo bellii.*
Increasingly rare summer resident of the river woods; its decline can probably be assigned to increased numbers of parasitic cowbirds in the vicinity.

Solitary Vireo, *Vireo solitarius.*
Uncommon in winter along the river. CBC.

Red-eyed Vireo, *Vireo olivaceus.*
Uncommon migrant, passing through the river woods.

Warbling Vireo, *Vireo gilvus.*
Uncommon migrant (probably slightly more likely to occur in spring than fall) in the river woods.

AMERICAN WOOD WARBLERS: PARULIDAE

(As the family name denotes, parulids are encountered in woods. Unless otherwise noted, the preferred habitat of the following species is the river corridor.)

Black-and-white Warbler, *Mnitotilta varia.*
Uncommon migrant and winter visitor. CBC.

Tennessee Warbler, *Vermivora peregrina.*
Rare migrant.

Orange-crowned Warbler, *Vermivora celata.*
Fairly common to common during migration and winter. CBC.

Nashville Warbler, *Vermivora ruficapilla.*
Fairly common migrant; a few overwinter some years. CBC.

Parula Warbler, *Parula americana.*
Arvin (1974) lists this species as common in spring, uncommon in fall, and occasional in winter.

†**Tropical Parula,** *Parula pitiayumi.*
Prior to 1950 probably nested along the river but now occurs in very small numbers only in Hidalgo and Kenedy (on the King Ranch) counties. If populations were to increase in the Delta, *pitiayumi* could conceivably reinhabit the Falcon woods, and it should be looked for. (See Oberholser 1974:733-734 for changes of this species in Texas.)

Yellow Warbler, *Dendroica petechia.*
Fairly common migrant.

Magnolia Warbler, *Dendroica magnolia.*
Rare migrant, recorded only in spring.

Yellow-rumped Warbler, *Dendroica coronata.*
This species has two well-marked races distinguishable in the field. Myrtle race, *D. c. coronata:* Common in migration and winter. Audubon's, *D. c. auduboni:* Uncommon in migration and winter. CBC.

Black-throated Gray Warbler, *Dendroica nigrescens.*
Rather rare in winter. CBC.

Blackburnian Warbler, *Dendroica fusca.*
Rare migrant, recorded only in spring.

Yellow-throated Warbler, *Dendroica dominica.*
Rare in winter. One CBC record.

Chestnut-sided Warbler, *Dendroica pensylvanica.*
Rare migrant, recorded only in spring.

Pine Warbler, *Dendroica pinus.*
Rare migrant and winter visitor. One CBC record.

Prairie Warbler, *Dendroica discolor.*
Rare in winter. One CBC record.

Northern Waterthrush, *Seiurus noveboracensis*
Uncommon migrant.

Louisiana Waterthrush, *Seiurus motacilla.*
Rare migrant, recorded only in spring.

Mourning Warbler, *Oporornis philadelphia.*
Rare migrant, recorded only in fall.

MacGillivray's Warbler, *Oporornis tolmiei.*
Rare migrant, recorded only in spring.

Yellowthroat, *Geothlypis trichas.*
Formerly probably nested but has not been reported in summer in recent years. Fairly common in migration and winter. CBC.

Yellow-breasted Chat, *Icteria virens.*
Formerly nested (prior to 1930) but now occurs only uncommonly during migration.

Wilson's Warbler, *Wilsonia pusilla.*
Common migrant; rare in winter. One CBC.

Canada Warbler, *Wilsonia canadensis.*
Rare migrant, recorded only in spring (first recorded: May 16, 1975, Kincaid, Winckler, Ira and Holly Carver).

Golden-crowned Warbler, *Basileuterus culicivorus.*
A common species in northeastern Mexico. One record: one individual seen in heavy river-bottom understory near Salineño on September 15, 1975, by Arvin (see *American Birds,* vol. 29, p. 85). (There are two 1892 specimens credited to Brownsville and a 1945 sight record near Harlingen.)

Rufous-capped Warbler, *Basileuterus rufifrons.*
A common Mexican species which ranges to Guatemala. One record: one individual seen one-quarter mile below the spillway in thick underbrush on February 10, 1973, by John L. Rowlett and Victor Emanuel. This species

breeds in the nearby Picacho Mountains of Mexico; besides the Starr County record, there have been several individuals seen in Big Bend National Park since 1973.

American Redstart, *Setophaga ruticilla.*
Uncommon migrant, recorded only in spring; probably occasional in winter. No CBC record.

WEAVER FINCHES: PLOCEIDAE

(An Old World family represented in the U.S. by the House Sparrow which has spread throughout the country since it was introduced in New York City in 1851.)

*House Sparrow, *Passer domesticus.*
Common resident, particularly around habitations; virtually absent from river woods. CBC.

BLACKBIRDS, ORIOLES, MEADOWLARKS: ICTERIDAE

Eastern Meadowlark, *Sturnella magna.*
Seeks open grasslands and fields. Apparently rare in winter but difficult to distinguish from Western Meadowlark, except by vocalizations. One CBC record.

Western Meadowlark, *Sturnella neglecta.*
Common migrant and winter visitor. CBC.

Yellow-headed Blackbird, *Xanthocephalus xanthocephalus.*
This western species is a rare migrant, occurring in cattail marshes, open fields, or around livestock pens.

*Red-winged Blackbird, *Agelaius phoeniceus.*
Common resident, inhabiting cattail marshes and thick *Baccharis* stands along the river. CBC.

Orchard Oriole, *Icterus spurius.*
Common migrant along the river. Since 1950s has retreated as nester from the Rio Grande Valley, probably due to continued clearing of mesquite.

Black-headed Oriole, *Icterus graduacaudus.*
Uncommon but regular resident of the river woods and adjacent mesquites. Species is probably somewhat more common in winter when birds from counties immediately to the north join resident Starr County individuals. This oriole has declined since the 1920s due to clearing of mesquite and, with the opening of the countryside, the increase in parasitic cowbirds. CBC.

Hooded Oriole, *Icterus cucullatus.*
Apparently increasingly uncommon summer resident; rarely reported in winter. Inhabits river woods. Once a common bird in the Valley, its decline coincides with the increase in cotton growing and the usage of DDT, herbicides, and defoliants combined with the increased cowbird population. (See Oberholser 1974:818 for a discussion of the species' decline.) One CBC record.

***Lichtenstein's Oriole**, *Icterus gularis.*
Uncommon to fairly common resident of the river woods, apparently on the increase in the Valley (see Oberholser 1974:828). One speculation as to reason for the increase is that the Lichtenstein's is large and aggressive enough to protect its nest from cowbirds and is filling the vacancies left by the declining oriole species. CBC.

Baltimore Oriole, *Icterus galbula.*
Rare migrant in river woods.

Bullock's Oriole, *Icterus bullockii.*
Uncommon nester with a preference for upland mesquite brush.

Brewer's Blackbird, *Euphagus cyanocephalus.*
Erratic winter visitor, but, when present, usually in good numbers. To be looked for around livestock pens and in open fields. Two CBC records.

*Great-tailed Grackle, *Cassidix mexicanus.*
Abundant resident, frequenting open areas (fields, towns, livestock lots, campsites in the park) and roosting at night usually in groves of trees. CBC.

*Brown-headed Cowbird, *Molothrus ater.*
Common migrant; abundant most winters; uncommon in summer. Occurs chiefly in livestock yards, fields, and towns, going to the river woods only to deposit eggs in other species' nests. CBC.

*Bronzed Cowbird, *Tangavius aeneus.*
This is the common cowbird of Mexico and Central America. In the U.S. it occurs only in south Texas, southern Arizona, and southern New Mexico. Very common in summer; largely withdraws in winter. Frequents situations like those of the Brown-headed. One CBC record.

TANAGERS: THRAUPIDAE

Summer Tanager, *Piranga rubra.*
Uncommon migrant in the river woods. Formerly nested in the Valley; now does so only rarely.

GROSBEAKS, FINCHES, TOWHEES, SPARROWS: FRINGILLIDAE

*Cardinal, *Cardinalis cardinalis.*
Fairly common resident in situations where trees, bushes, and tall weeds occur, whether in town or country. CBC.

*Pyrrhuloxia, *Pyrrhuloxia sinuata.*
An aridland counterpart of the Cardinal, sympatric with it in Texas. Common resident (abundant some winters) in both the river woods and upland scrub. CBC.

Rose-breasted Grosbeak, *Pheucticus ludovicianus.*
Occasional migrant in the river woods, recorded only in spring.

Black-headed Grosbeak, *Pheucticus melanocephalus.*
Occasional in migration (recorded only in spring) and in winter in the river woods.

*Blue Grosbeak, *Guiraca caerulea.*
Uncommon summer resident, inhabiting semiopen situations with scattered trees and brush.

Indigo Bunting, *Passerina cyanea.*
Uncommon migrant.

Varied Bunting, *Passerina versicolor.*
Occurs from southern Arizona and southwestern Texas to Guatemala, along rivers, streams, and arroyos. Rare

migrant (recorded only in spring) and in summer (no specific nest records, but has nested in nearby Cameron County).

*Painted Bunting, *Passerina ciris.*
Common in summer and migration; nests chiefly in upland mesquite brush.

Dickcissel, *Spiza americana.*
Uncommon migrant to be encountered primarily in weedy fields and along country lanes.

House Finch, *Carpodacus mexicanus.*
Uncommon in winter; has occurred in summer but nesting unconfirmed.

†**White-collared Seedeater**, *Sporophila torqueola.*
A common species in Mexico and Central America. Prior to 1950, common in the Rio Grande Valley, now increasingly rare and sporadic. Prefers thick weeds, grass, or cattails along or near the river (see Oberholser 1974:880 for account of changes). Arvin (personal communication) rarely sees this species in the Valley. One CBC record.

Pine Siskin, *Spinus pinus.*
Rare in winter.

American Goldfinch, *Spinus tristis.*
Fairly common in winter, seen in flocks either on the wing or perched in trees or weeds. CBC.

Lesser Goldfinch, *Spinus psaltria.*
Uncommon winter visitor; absent some winters. Seen in situations similar to the American Goldfinch's. Two CBC records.

*Olive Sparrow, *Arremonops rufivirgata.*
A neotropical species which ranges from south Texas to Costa Rica. Fairly common resident in dense vegetation along the river and in adjacent mesquite scrub. CBC.

Green-tailed Towhee, *Chlorura chlorura.*
Rare in winter, to be looked for in thickets and brushy arroyos.

Rufous-sided Towhee, *Pipilo erythrophthalmus.*
Rare in winter; to be looked for in riverside thickets. CBC.

Lark Bunting, *Calamospiza melanocorys.*
Generally common in migration and winter in flat upland areas (e.g., the air strip at the state park). CBC.

Savannah Sparrow, *Passerculus sandwichensis.*
Uncommon in winter in weedy fields and various thickety situations. CBC.

Grasshopper Sparrow, *Ammodramus savannarum.*
Rare in winter; however, this bird skulks in thick vegetation and is seldom seen, so it may be more numerous than records indicate. One CBC record.

LeConte's Sparrow, *Passerherbulus caudacutus.*
One record: one seen December 27, 1972, by Rose Ann Rowlett and me. The status of this very reclusive sparrow is difficult to access; it probably winters at least occasionally in weedy fields.

Vesper Sparrow, *Pooecetes gramineus.*
Fairly common in winter in weedy fields, thickets, etc. CBC.

Lark Sparrow, *Chondestes grammacus.*
Common resident in mesquite uplands; a bit more numerous in winter when individuals move in from the north. Arvin (1974) lists as common year round; no nesting evidence in Oberholser (1974). CBC.

Rufous-crowned Sparrow, *Aimophila ruficeps.*
Rare in winter, probably occurring in brushy uplands or rocky dry arroyos.

*Cassin's Sparrow, *Aimophila cassinii.*
This drab-plumaged sparrow is common in summer in the brushy mesquite uplands; during the nesting season it is easy to identify by its trilling song and aerial display. In winter, when it is silent, it is harder to census, but apparently it is uncommon during the cool months. CBC.

*Black-throated Sparrow, *Amphispiza bilineata.*
Abundant resident (fewer in winter) in brushy mesquite uplands. CBC.

Chipping Sparrow, *Spizella passerina.*
Rare in winter, usually found in weedy fields. Two CBC records.

Clay-colored Sparrow, *Spizella pallida.*
Fairly common some winters, uncommon others, in weeds, thickets, and brush. CBC.

Field Sparrow, *Spizella pusilla.*
Rare in winter. One CBC record.

White-crowned Sparrow, *Zonotrichia leucophrys.*
Fairly common most winters in weedy, thickety places. CBC.

White-throated Sparrow, *Zonotrichia albicollis.*
Rare winter visitor. One CBC record.

Lincoln's Sparrow, *Melospiza lincolnii.*
Common winter visitor, most frequently seen amid riparian vegetation. CBC.

Swamp Sparrow, *Melospiza georgiana.*
Uncommon in winter in wet situations—river vegetation or cattail marshes. CBC.

Song Sparrow, *Melospiza melodia.*
Rare in winter in tall grass and weeds, usually along the river or in cattail marshes. Two CBC records.

McCown's Longspur, *Rhynchophanes mccownii.*
Longspur are northern-nesting species that very rarely winter as far south as south Texas. One specimen: near Rio Grande City (April 10, 1880, collected by M. A. Frazar). Any longspur in Starr County, including this and the next species, should be considered a very rare event.

Chestnut-collared Longspur, *Calcarius ornatus.*
One specimen (see Oberholser 1974:966).

REFERENCES

American Birds (formerly *Audubon Field Notes*). 1968-1975. Vols. 22-29. Number 2 of each volume contains "Falcon Dam, Texas" Audubon Christmas Bird Count for that year. New York: National Audubon Society and U.S. Fish and Wildlife Service.

Arvin, John C. 1974. *Birds of Falcon State Park, A Checklist* (revised edition). Austin: Texas Parks and Wildlife Department.

Oberholser, Harry Church, 1974. *The Bird Life of Texas* 2 vols., edited by Edgar B. Kincaid, Jr., John L. Rowlett, and Suzanne Winckler. Austin: University of Texas Press.

TABLE I

Winter Birds of Falcon Area as censused on Audubon Christmas Bird Counts 1968-1974
(x means bird was present but exact number not available)

	1 Jan 1968	1 Jan 1969	22 Dec 1969	3 Jan 1971	28 Dec 1971	27 Dec 1972	19 Dec 1973	22 Dec 1974
Common Loon			1	2		2	1	4
Eared Grebe	24		2	4	23	35	2	6
Least Grebe							1	1
Pied-billed Grebe	3	6	4	3		4	8	5
Double-crested Cormorant	4	1	3	16	34		6	85
Olivaceous Cormorant					72	2	x	127
Anhinga						1		
Great Blue Heron	33	7	20	6	19	16	43	83
Green Heron						1		
Cattle Egret	36			5	68	53		1
Great (Common) Egret	1		3	1	x		2	3
Snowy Egret			13					29
Black-crowned Night Heron					x			
Louisiana Heron								1
White-fronted Goose						21		22
Gadwall		9	38	38		5	11	133
Pintail	62		147	2			15	5
Green-winged Teal	18	1	20	24	x		1	11
Blue-winged Teal								2
Cinnamon Teal				8				3
Shoveler	14			2			2	1
American Wigeon			27	42		17	10	68
Wood Duck								1
Redhead				2				
Ringed-necked Duck			31	1				
Canvasback			8	1				12
Greater Scaup								1
Lesser Scaup	10		43	4			109	4
Bufflehead	22			2			4	1
Ruddy Duck			6				1	
Red-breasted Merganser			3		x			2
Turkey Vulture			2	6	12	7	7	168
Black Vulture				2	11	8	8	123
White-tailed Kite							x	
Sharp-shinned Hawk	1		1	2	1	3	x	5
Cooper's Hawk			2	1	1	1		1
Red-tailed Hawk	3	4	4	3	3	8	2	6
Red-shouldered Hawk						2		
Broad-winged Hawk						1		
Zone-tailed Hawk								2
Gray Hawk					1		1	
Harris Hawk	5	15	12	3	26	14	17	12
Marsh Hawk	2	3	2	6	4	6	5	6
Osprey		1	1	1	2	2	2	3
Peregrine	1							
Merlin (Pigeon Hawk)						1		2
Kestrel (Sparrow Hawk)	7	8	10	3	15	13	21	19
Chachalaca			6		3	36	15	31
Bobwhite		1		11	8	117	66	33
Scaled Quail		18	15	1		26	79	35
Sandhill Crane							30	
Sora				1	5	4	2	1

	1 Jan 1968	1 Jan 1969	22 Dec 1969	3 Jan 1971	28 Dec 1971	27 Dec 1972	19 Dec 1973	22 Dec 1974
Common Gallinule							1	1
Coot	32	138	100	119	43	31	26	26
Killdeer	12	10	18	28	28	24	21	65
Black-bellied Plover								1
Woodcock						1		
Common Snipe	3	1	6	10	1		5	11
Long-billed Curlew							x	
Spotted Sandpiper	4	3	13	9	22	16	10	41
Solitary Sandpiper							1	
Greater Yellowlegs			1	2	1	2	2	6
Lesser Yellowlegs	18		77	78	51	89	66	213
Semipalmated Sandpiper			6					
Western Sandpiper			20	3	1	1		
Glaucous Gull					1			
Iceland-Thayer Gull					1			
Black-legged Kittiwake					1			
Herring Gull					36	1	6	
Ring-billed Gull	12	7	18	93	227	62	218	81
Laughing Gull							x	1
Bonaparte's Gull	1						1	
Forster's Tern								1
Red-billed Pigeon			1		2			
Mourning Dove	182	21	39	61	218	108	38	155
Ground Dove	1		3	6	26	30	3	15
Inca Dove		10	1		11	5	4	6
White-fronted Dove			3	3	10	6	1	6
Roadrunner	3	2	1	1	1	5	6	6
Groove-billed Ani					5	8		
Barn Owl		2			3	5	7	
Screech Owl			2	1	3	4	2	4
Great Horned Owl	4	1	11	2	6	10	4	11
Ferruginous Owl			2					
Poorwill					1			
Pauraque	2	3	26	4	19	10	7	13
Buff-bellied Hummingbird					1			
Belted Kingfisher	4	5	14	5	17	14	13	21
Ringed Kingfisher	1	1	3	2	5	11	12	18
Green Kingfisher	2	1	13	4	17	9	3	23
Yellow-shafted Flicker			2			3	2	6
Red-shafted Flicker	1							
Golden-fronted Woodpecker	12	12	44	25	73	46	8	47
Yellow-bellied Sapsucker	1		4		3	6		2
Ladder-backed Woodpecker	6	5	20	7	49	56	9	54
Tropical Kingbird	5				31		2	3
Kiskadee	7	6	49	11	49	29	32	107
Eastern Phoebe	1	2	10	6	13	18	4	19
Say's Phoebe		1	1	1	2	6	3	5
Empidonax sp.					1	1	1	2
Vermilion Flycatcher	6	2	3	1	6	5		7
Horned Lark			2					
Rough-winged Swallow					1	3	9	4
Barn Swallow								1

	1 Jan 1968	1 Jan 1969	22 Dec 1969	3 Jan 1971	28 Dec 1971	27 Dec 1972	19 Dec 1973	22 Dec 1974
Brown Jay								27
Green Jay	14	28	38	18	53	51	26	87
White-necked Raven	1	5	17	9	31	20	1	87
Mexican Crow					1			
Black-crested Titmouse	6	6	25	12	62	26	15	34
Verdin		1	6	15	12	43		4
Brown Creeper						1		1
House Wren	12	9	45	14	82	69	9	42
Winter Wren			1			1	1	7
Bewick's Wren	8	6	13	10	24	23	9	21
Carolina Wren		1						3
Cactus Wren	2	8	4	4	32	35	1	15
Long-billed Marsh Wren			1	5	1		1	5
Short-billed Marsh Wren								1
Rock Wren	1		4	2	x	2	x	4
Mockingbird	65	32	106	31	60	97	41	43
Catbird						1		
Long-billed Thrasher	8	8	29	17	39	48	5	69
Curve-billed Thrasher	6	12	27	7	17	19	2	18
Sage Thrasher	1		1					
Robin		1	60		1	69	7	19
Hermit Thrush			1		1	3	2	20
Eastern Bluebird					2			2
Blue-gray Gnatcatcher	13	16	25	6	136	58	21	57
Black-tailed Gnatcatcher	2				1			
Golden-crowned Kinglet			2			1	2	7
Ruby-crowned Kinglet	9	11	38	14	113	154	31	174
Water Pipit	15	3	4	6	12	8	17	54
Sprague's Pipit			4					
Cedar Waxwing		5	15		31	54	7	302
Loggerhead Shrike	10	12	9	6	13	13	19	25
Starling	2							
White-eyed Vireo			1	1	12	3	2	8
Solitary Vireo	1		1		1	1		8
Black-and-white Warbler					2	1	x	1
Orange-crowned Warbler	7	15	21	4	63	102	22	92
Nashville Warbler					11	2		1
Yellow-rumped Warbler								
Myrtle race	21	9	59	24	220	64	11	76
Audubon's race	2		10		14	4	1	3
Black-throated Gray Warbler			1			1		1
Pine Warbler								1
Prairie Warbler					1			
Yellow-throated Warbler					1			
Yellowthroat	34	20	54	15	23	46	5	20
Wilson's Warbler					4			
House Sparrow	46	6	75	94	21	41	25	82
Eastern Meadowlark					6			
Western Meadowlark	1	1	1	4	5	31	11	37
Red-winged Blackbird	23	35	24	2033	152	2001	1	44
Black-headed Oriole			3	1	1	7	1	10
Hooded Oriole						1		

	1 Jan 1968	1 Jan 1969	22 Dec 1969	3 Jan 1971	28 Dec 1971	27 Dec 1972	19 Dec 1973	22 Dec 1974
Lichtenstein's Oriole			3	4	11		3	25
Brewer's Blackbird			80		20			
Great-tailed Grackle	724	60	36	74	523	1415	198	1046
Brown-headed Cowbird		14	35	1017	23	5	1	55
Bronzed Cowbird					39			
Cardinal	10	12	86	11	43	53	16	84
Pyrrhuloxia	14	216	79	58	33	265	147	50
House Finch							x	
American Goldfinch	1		17		58	19	2	33
Lesser Goldfinch					26			3
White-collared Seedeater								1
Olive Sparrow	1		27	2	23	27	24	42
Rufous-sided Towhee				1	1	1		
Lark Bunting	106	81	1	5	62	56	76	2
Savannah Sparrow	12	6	7	12	5	3	4	14
LeConte's Sparrow						1		
Grasshopper Sparrow								1
Vesper Sparrow	1	2	3	3	26	45	1	20
Lark Sparrow	65	16	30	20	35	78	5	45
Cassin's Sparrow	1	1	19		2	6	x	3
Black-throated Sparrow	6	3	5	4	2	40	23	3
Chipping Sparrow						8		12
Clay-colored Sparrow	42	4	3	2	5	104	1	4
Field Sparrow					2			
White-crowned Sparrow	23	5	2			18	18	10
White-throated Sparrow						1		
Lincoln's Sparrow	14	2	30	3	21	51	7	42
Swamp Sparrow	2	1	2		2	17	1	7
Song Sparrow						1		4

NUMBER OF OBSERVERS

1 Jan 1968: one observer
1 Jan 1969: one observer
22 Dec 1969: five observers
3 Jan 1971: four observers
28 Dec 1971: eight observers
27 Dec 1972: seven observers
19 Dec 1973: six observers
22 Dec 1974: fourteen observers

AN ARCHEOLOGICAL RECONNAISSANCE OF A PORTION OF THE RIO GRANDE STARR COUNTY, TEXAS

Nancy O'Malley

During July of 1975, an archeological reconnaissance of a small area below the Falcon Dam spillway was undertaken by archeologists Nancy O'Malley and Michael Mallouf. Approximately eight river km were surveyed with an inland range of approximately one-eighth km [see map]. In addition, three arroyo systems were surveyed from near the main-stem river channel to approximately 1.6 km inland. A total of 31 sites was recorded during one week of surveying. In order to preserve the sites for later work, systematic artifact collection was not practiced. Artifacts considered important to preliminary site evaluation were photographed and sketched. Photographs were also taken of the site area, or a representative portion thereof, and of any observed features such as hearths and shell accumulations.

Southeast of Salineño selected locales where historic sites were known to occur also were surveyed and resulted in the recording of three historic sites with extant structures and two prehistoric sites in close proximity.

Samples of lithic materials were collected from three commercial gravel pits in order to determine the variety of such resources available for tool manufacture. A discussion of the kinds of lithic materials available is included under the section "Recorded Sites."

ENVIRONMENT

The present environment in the study area is a dry, rolling, largely brushland landscape with a subtropical woodland belt along the main river channel and some of the arroyos. The countryside supports prickly pear, mesquite, and spiny hackberry with a variety of other cacti, thorny brush, and some grasses. Rainfall averages slightly more than 50 cm (20 in) annually, which, when combined with the high temperatures, creates a hot, semiarid climate (Johnson 1931:42). Droughts are relatively common, and the sudden, though brief, thunderstorms generate rapid runoff and erosion. This environment is included in one of three major biotas represented in Texas, that of the Neotropical category. The fauna of this biota are present in "progressively dilute form" (Blair 1950:95) in the brushlands of the Rio Grande Plain. The Tamaulipan province, a subdivision of the Neotropical biota, contains the study area. As mentioned before, the vegetation is predominantly thorny brush. Inhabiting this vegetational region are various species of mammals, reptiles, and amphibians as well as a number of birds, some of which have inhabited the area only since the completion of the reservoir.

Underlying this area, forming the base for all the surficial environmental manifestations, are sediments of Eocene age, predominantly of marine origin. The stratigraphic sequence includes two units, the Crockett and the Yegua Formations. The Crockett Formation is "predominatly cemented sandstone . . . [with] layers of clay, fossiliferous limestone, and limestone concentrations" (Maxwell 1970:89). The Yegua Formation overlies the Crockett and consists of marine clays with some lignitic sandstone.

The present environment appears to differ slightly from that of the prehistoric period. Although the climate probably has not changed to any great degree in the last few millenia, it is clear that the floral and faunal situation has been altered in the last 200 years. Along the river and up some of the arroyos which still run intermittently, a riparian zone exists, supporting dense vegetation and much wildlife (Fig. 1). This zone is virtually impossible to survey during the spring or summer. We made several attempts but abandoned them due to the denseness of the undergrowth. The riparian zone of lush semitropical vegetation is restricted principally to that area along the mainstream river channel and extends a short distance inland along the banks of some of the larger arroyo systems. The character of the riparian zone has probably changed less than the uplands since prehistoric times. Yet the archeological situation suggests a more extensive riparian zone in times past. The reason for this shrinkage of the riparian zone can be found in the uplands. During the reconnaissance, it was noticed that semiarid species grow at the banks of the arroyos which are dry and barren of any subtropical vegetation. Archeological sites are exposed by the severe erosion, often damaged or destroyed in as much as 50% of their suspected area. This acceleration of erosion and desiccation has taken place

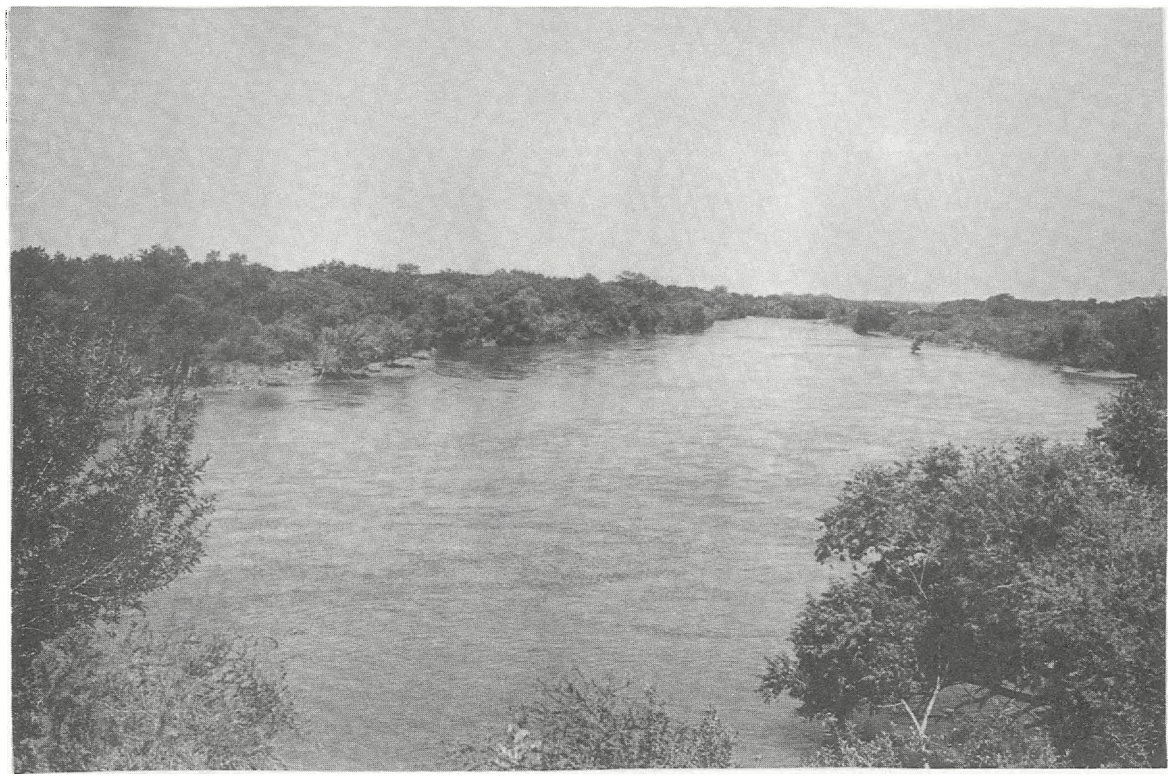


FIGURE 1

The Rio Grande and associated dense vegetation of the riparian zone.

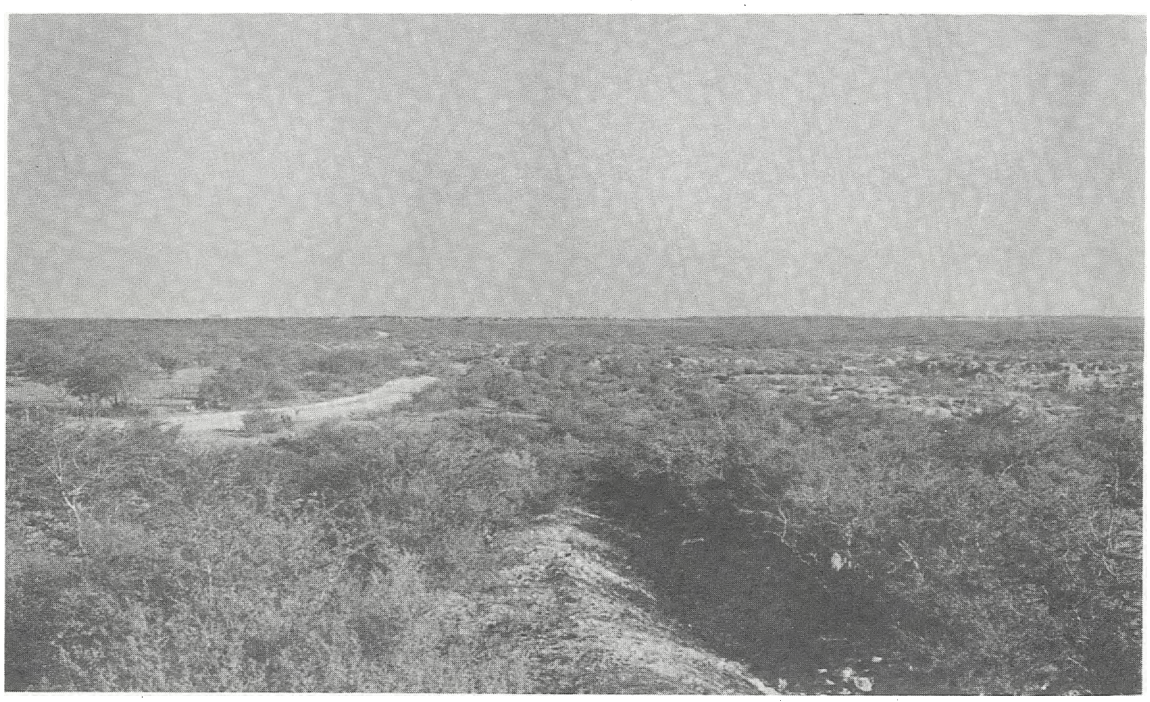


FIGURE 2

Rolling brushland typical of the uplands.

largely in the last 200 years due to the land use practices in this area (Figs. 2 and 3).

The uplands zone used to be primarily grasslands with occasional sporadic brush growing in limited localities (Bogusch 1952:86). With the onset of European settlement, cattle, sheep, and goats were all pastured at different times on these grassy plains. When John Russell Bartlett, a surveyor working for the Texas government, passed near the area in the early 1850s, he noted grasslands 25.6 km (16 miles) north-northeast of Rio Grande City extending south nearly to the river belt (Inglis 1964:69). This area is presently covered with thorny brush of the chaparral variety with very little of the original grasslands remaining. Some of this land has been reseeded for modern cattle production, but much of the area still supports mesquite, spiny hackberry, prickly pear, acacia, catclaw, and other semiarid species. Most of the older grassland soils have been eroded away, allowing brushland encroachment. In much of the study area, this severe erosive damage continues to occur with little or no interference on the part of ranchers. Buffel grass has spread in parts of the survey area, particularly within the reservation boundary, stabilizing the soil somewhat; however, much of the land used for cattle grazing has been virtually denuded. The direct results of the overgrazing in this area are obvious. Erosion has increased and is responsible for the destruction and dissection of many land surfaces including those containing archeological deposits. More indirectly, the loss of a grass cover on the land has decreased the amount of water that percolates through the soil, affecting the local water table and decreasing the extent of the riparian zone. Many of the arroyos that are now dry all year round probably were formerly intermittent streams suitable for seasonal use by the prehistoric inhabitants. This is certainly borne out by the high density of sites found along these arroyos.

ARCHEOLOGICAL BACKGROUND

The study area is contained in a part of Texas that has been traditionally referred to as "Southwest Texas" (Suhm, Krieger, and Jelks 1954), the "Western Gulf Culture Area" (ewcomb 1961), and more recently, as a part of the "Diablo Range" (Jelks 1975). The latter term covers much more territory than the two former, but all three deal with similar cultural manifestations. This lifestyle is based on subsistence economy practiced by nomadic or seminomadic peoples hunting game, fishing, and foraging for plants over a culturally prescribed range. Areal variations are expected and common, the various cultural groups being homogeneous only in a very general sense.

This basic subsistence economy has existed for thousands of years in North America. During this time, some broadly perceived changes have taken place, and these have been defined in the archeolog-

FIGURE 3

Arroyo cutting and erosion typical of the study area.

ical record as cultural stages. According to Suhm, Krieger, and Jelks (1954:136,142), the traditional chronological scheme consists of three major stages, the earliest being known as the Paleo American (Paleo-Indian), followed by an extensive, varied, and widespread cultural period known as the Archaic, and a briefer period known as the Neo-American. To this scheme will be added a recently suggested phase known as the Pre-Archaic which falls between the Paleo-Indian and Archaic stages (Hester 1975a:5).

The Paleo-Indian stage is characterized by large, sometimes fluted, projectile points and other related artifacts associated with late Pleistocene fauna now extinct and a subsistence pattern seemingly based on the hunting of large game. Artifacts ascribed to this period have been collected along the Rio Grande as "isolated finds on high stream terraces and in upland situations" (Hester 1974:11). Whether these finds indicate hunting losses or whether these high locales were favored camping areas is unknown (Hester 1974:12). A good understanding of this period is yet to be had, although studies in various parts of Texas currently are underway. Most of the information presently available from South Texas generally refers to the later phases of this stage. The occurrence of artifacts associated with the later manifestations of the Paleo-Indian stage, which includes artifacts of the Plainview type and its variants and other lanceolate and stemmed forms, is well documented in south and southwest Texas (Hester 1973; Weir 1956, and others).

The Pre-Archaic phase, recently suggested by Sollberger and Hester (1972), is characterized by corner-notched and triangular dart points, large barbed forms, and stemmed forms (Sollberger and Hester 1972; Hester and Kohnitz 1975). This transitional phase is the first attempt to assign a name to that nebulous period of time surrounding the transformation of one dominant life style into another, in this case, that of the Paleo-Indian stage into the Archaic. That a period of adjustment occurred during this time is fairly clear from excavations in various parts of Texas (see Johnson's "Early Barbed Phase," 1964; Sorrow, Shafer, and Ross 1967, and others); however, the term "Pre-Archaic" may prove to be somewhat inadequate or misleading as a name for this phase.

The Archaic stage in south and southwest Texas appears to have been quite extensive, beginning around 6500 B.C. and possibly persisting until historic times in some areas. Several Archaic sites were investigated during an archeological survey and testing of the Falcon Reservoir area in the 1950s (Kriegar and Hughes 1950; Hartle and Stephenson 1951; Cason 1952). A generalized scheme composed of two foci, the Falcon and Mier, was proposed for the reservoir area (Suhm, Krieger, and Jelks 1954:136-142); however, this scheme has not been applicable to areas outside of the reservoir. In fact, research indicates that south Texas was an extremely diverse area of cultural adaptation, differing from drainage to drainage in tool manufacturing technology, artifact assemblages, and response to environmental factors (Nunley 1971b; Hester 1975a). In a general sense, artifact assemblages expand to include more types of tools; a greater reliance is placed on the collection of vegetables, and other cultural attributes, such as evidence of ritual, are noticeable in quantity for the first time. This is not to say that ritual was not in existence at an earlier time, simply that recognizable evidence of it is scanty.

Some parts of south Texas experienced an introduction of small projectile points, interpreted as "arrowpoints," around 1200 B.C. In addition, new tool forms and bone-tempered ceramics often accompanied the small points (Nunley and Hester 1975:7). This stage is termed the Neo-American or Late Prehistoric and is fairly well-documented in south Texas; however, based on previous work, materials from this stage are virtually absent from the Rio Grande area in Starr County (Hester 1975a:10), and a lengthy discussion will not be pursued here. Nevertheless the possibility of materials from this stage occurring should not be ignored.

This later stage was brought to an end when Europeans entered the area and began exerting their influence on the native inhabitants. The pressures brought to bear on the relatively small native populations in the form of disease, hostile settlers, and proselytizing missionaries resulted in the virtual extinction of the Indians. By 1840 the native inhabitants of south Texas had disappeared, either dead from disease or war or assimilated into the Mexican population (Newcomb 1961:36). Very limited evidence exists in the archeological record for the historic aboriginal period (Hester 1970; Mitchell 1974) in this area, and sites reflecting the interaction between Europeans and Indians should be sought.

ETHNOHISTORICAL BACKGROUND

When the Spaniards first entered south Texas, they found the residents there to be totally unlike any human population known in Europe. The Indians they met were nomadic wanderers who wore very little clothing, did not construct permanent housing, and consumed virtually anything edible. By Spanish standards, these natives represented a new low in savagery and cruelty. Various traders recorded bits and pieces of information concerning the diverse cultural

groups in the area of south Texas over a period of 300 years. Modern ethnographers have attempted to paint a picture of the south Texas Indian's way of life, a picture that is full of gaps, omissions, and unsubstantiated claims. For many years, the "facts" concerning the south Texas groups were accepted with little or no question. Recently, however, the information available on these groups has been challenged (Nunley 1971a; Campbell 1973, 1974).

The Indians of south Texas are categorized linguistically under the family name Coahuiltecan (Newcomb 1961:30). Unfortunately, this term has been misused in the sense that diverse cultural groups within the area are lumped together under one rubric, resulting in the mistaken idea that the bands and band-clusters roaming south Texas at the dawn of historic times were a homogeneous cultural entity.

On the contrary, certain bands were often at war with other bands, and dialects seem to have been mutually incomprehensible throughout the area (Nunley 1971a:303). Evidence of specific cultural variations between the bands is only scantily available and often is limited to one area such as the Nuevo Leon province in Mexico (Ruecking 1953, 1954a, 1954b, 1955a, 1955b). The only original documents currently available on the Coahuiltecans are those translated accounts written by Cabeza de Vaca in the 16th century (Nuñez Cabeza de Vaca 1907; Bandelier 1904; Corey 1961), Alonzo de Leon in 1649 (Duaine 1971; De Leon 1905 [in Spanish]), and Fray Vicente Santa Maria in the 18th century (Holden 1924). Nunley (1971a) discusses the problems inherent in the interpretation of these documents. General information on the various cultural habits of many of the Coahuiltecan bands is readily available (Ruecking's works cited above; Newcomb 1961, Troike 1959, 1962; Skeels 1972; Swanton 1940).

Certain band affiliations have been postulated for various time periods. The band or band-cluster reported to have lived near the survey area is known as the Carrizos. Linguistic evidence suggests that the Carrizos are a cluster of individual bands with similar cultural development and habits and a mutually understandable language or dialect (Ruecking 1954a:8-9).

The Coahuiltecan bands were succeeded by tribes moving into south Texas during historic times. The Comanches, Kiowas, and the Lipan and Mescalero Apaches began intensive raiding of the area in 1836-1837. This sudden flurry of raiding activities was brought about by the reduction in Texas military garrisons and the increased settlement by Europeans in the upper Trans-Mississippi area (Vigness 1955:15-16). Eventually, however, these tribes were subjugated, and the settlement of the Rio Grande Plain was complete.

RECORDED SITES

Condition of the Sites

During the reconnaissance, it was noted that virtually all the recorded sites had suffered damage from erosion. In fact, in many cases, erosion was the main factor in discovery of the sites. Most of the sites were located on the banks of arroyos, which, without exception, have all been subjected to erosion (Fig. 4), the single most destructive factor adversely affecting the preservation of the sites in the study area. The need for reclamation of these land surfaces cannot be stressed too strongly. This could be achieved partly by the cessation of grazing so that the grassy vegetation could restabilize the slopes.

In addition to the destruction of sites through erosion, we were aware that a considerable amount of artifact collecting was practiced by relic hunters among the local inhabitants. Since most collectors select only finished tools from the sites and rarely record their finds as to exact site location, the potential information a site could yield through excavation and analysis is diminished. If sites are collected over and over again, the losses can result in a severe distortion of the artifact assemblage, particularly when dealing with deflated site conditions.

Other types of damage that have occurred in the study area include dirt roads passing through the sites and land-clearing activities. Roads tend to compress the soil body and may actually aid in the preservation of buried sites by compacting the soil sufficiently so that water has less chance to carry sediments with it. However, roads have an indirect effect by providing relatively easy access to the site and encouraging nonprofessional collection of artifacts. Land-clearing activities remove what little vegetation holds the soil in place, leaving the land easy prey to erosion.

Of the 31 sites recorded during the present reconnaissance, 22 sites are prehistoric, three are mixed historic-prehistoric sites with historic structures, and six are mixed sites without structures. In recording the mixed sites, it was often difficult to separate the prehistoric from the historic component. Where topographic features indicated a separation, sites were recorded separately, although erosion often mixed the sites enough to make such separation extremely difficult. In such cases, sites were recorded as being mixed.

Prehistoric Sites

Approximately 71% of the recorded sites contain prehistoric components. Two categories of sites which include occupation and quarry sites were noticed. Occupation sites were by far in the majority, comprising 20 of the 22 prehistoric sites recorded (Fig. 5). Because of the cursory nature of the

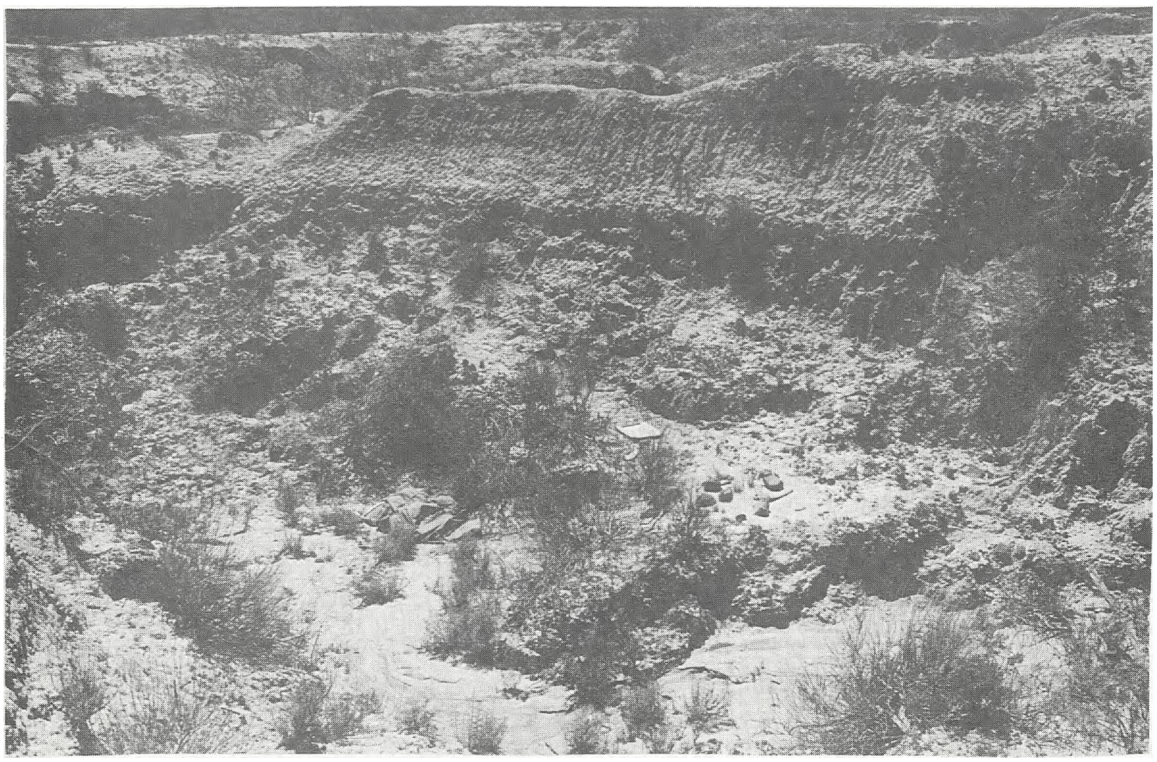


FIGURE 4

Extensive erosion found on two typical sites of the study area.

FIGURE 5

Typical occupation site of the study area.

reconnaissance and the lack of time available for careful, in-depth study of the sites and the artifacts, formal divisions within the occupation site category will not be attempted; however, certain characteristics of the prehistoric settlement in the study area were noted and will be discussed in general terms.

Occupation sites differed in the density of artifacts, the presence of diagnostic or otherwise recognizable tool forms, and in the faunal remains, notably mussel and snail shell. A relatively small number of sites contained artifacts and/or features that might be construed as occupations of an extended nature, meaning those locales that might have been seasonally and/or repeatedly occupied over a number of years. These sites are in contrast to those exhibiting only a thin lithic scatter. One "marker" that seems an important factor in determining occupational intensity is the presence of freshwater mussel shell remains. Whereas most sites contain snail shell in abundance, the presence of mussel shell is much more variable. Although the presence of mussel shell should not be used as the only criterion, when combined with a high precentage of flint debris and the presence of diagnostic tool forms that may indicate activities such as woodworking, clothing and tool manufacture, or food preparation, it is not unreasonable to assume a fairly varied and intense occupation. Specific variations among the occupation sites are unclear; however, further work under carefully controlled circumstances could clarify the situation.

The "lithic scatter" sites mentioned above are simply those locales containing flint debris and possibly some bifacially chipped forms. Mussel shells are generally, although not always, lacking in these sites, but snails are abundant. Usually, these sites appear shallow, and artifact density is low. Some of these sites may represent "chipping stations," either with or without associated faunal remains.

The most abundant faunal remains noted during the reconnaissance were snail shells. These shells were observed at every site except one, a quarry site on a high gravel ridge. A great many species are known to occur in the Rio Grande Plain, so their presence on archeological sites is, at least in part, natural. Prehistoric human consumption of these fauna has not been adequately demonstrated; however, their presence on sites in unnatural numbers may indicate their use as a food resource. To test this hypothesis, a study could be implemented to gather data on the presence of snails in archeological sites. Snails could be analyzed in terms of the ratio of juveniles to adult individuals, since the latter would be a more likely candidate for human consumption. Toward this end, the habits of snails, such as the congregation of literally hundreds of individuals during the mating season in a small area, should be taken into consideration. The normal death rate in the snail population is thus increased for one locality. This could cause distortion in the normal snail distribution over an area (John Clark 1975: personal communication).

The quarry sites, of which only two were definitely recognized, are those locales with outcrops or large accumulations of raw lithic materials. In the study area, these two sites are located on relatively high ridges covered with large cobbles (Fig. 6). One of the sites has a sandstone outcropping on the south side of the ridge. This same site has an accumulation of burned rock that is suggestive of a hearth, possibly used for warmth or to thermally treat the lithics. The other quarry site is much less rugged in topography and no sandstone outcropping was noted. Cores and large primary flakes are common at both sites.

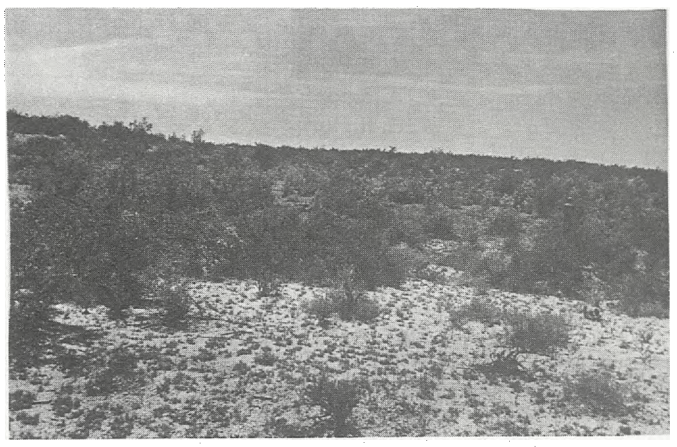


FIGURE 6
Quarry Site 41SR184.

Artifactual material at the prehistoric sites is plentiful, particularly from the standpoint of lithic debitage. Although amateur collecting of finished specimens is rampant, some tool types were recovered for photographing. In the projectile point class, all the specimens observed are unstemmed forms. The majority are triangular in shape. Other classes of artifacts include various kinds of unifacially chipped forms, utilized or retouched flakes and chips, and a variety of bifacial forms. Controlled collecting and careful analysis of these artifacts would no doubt shed considerable light on the tool manufacturing technology of the prehistoric inhabitants. This research, combined with a study of the local lithic resources, could also clarify the patterns of resource procurement by various groups in the area through time. A brief discussion of locally available raw lithic materials follows.

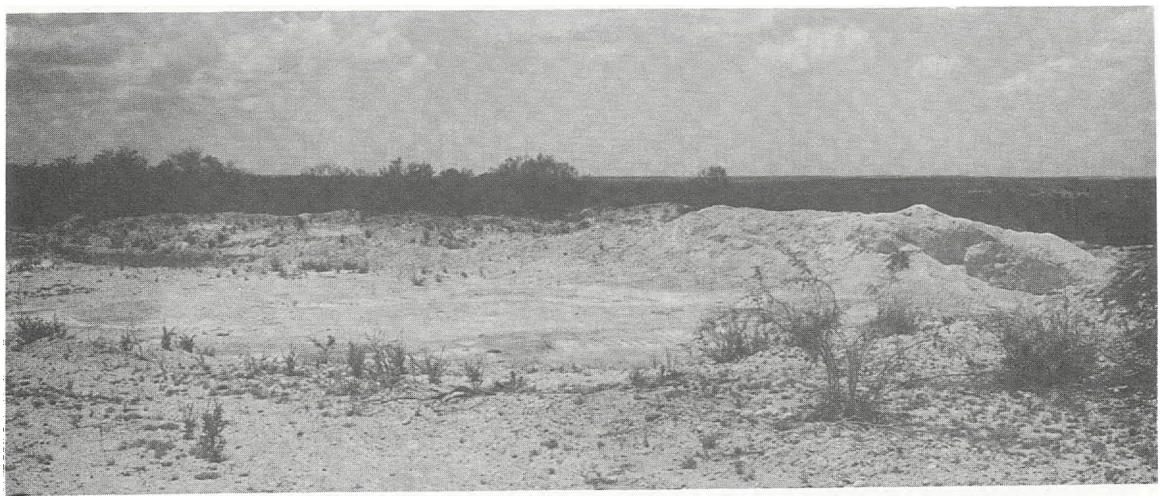


FIGURE 7
Gravel Pit No. 3.

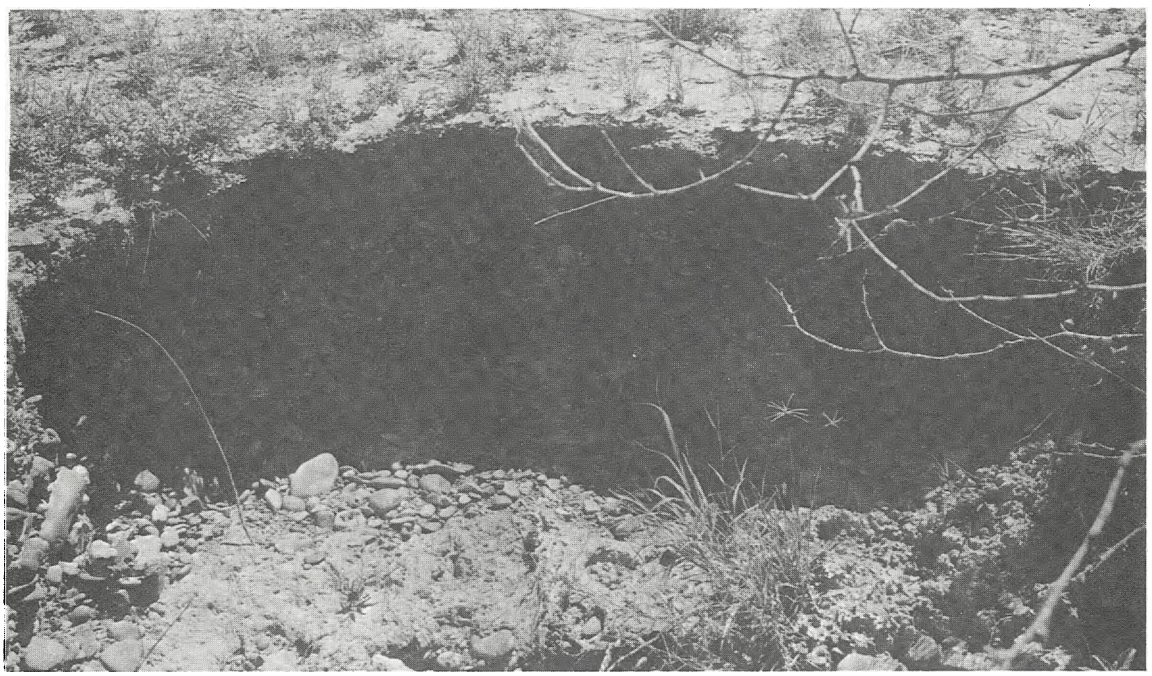


FIGURE 8
Gravel bar in two small arroyos near the main river channel.

Available Lithic Resources

Within and adjacent to the study area are abundant sources from which lithic materials could be procured. Gravel is mined commercially at several localities and high terrace gravel deposits are common, especially in the southern part of the area (see photogeologic map and geology section of this report). Lithic samples were collected at three of the gravel pits in order to observe the variety of rock available for use by the prehistoric or later inhabitants. Resources could also be procured from the gravel bars along the river and in the cut banks of the arroyos (Figs. 7 and 8).

Collected samples were identified by Leon Byrd and Cader Shelby of the Texas Water Development Board. The bulk of the samples contained flint or rhyolite, the flint being extremely varied in color and texture. Colors ranged from white to all shades of red and pink to browns, tans, and grays. A black flint was observed on the sites in small numbers as well. Texture varied from highly fractured to smooth glassy flint with good cleavage. Some flint was observed to have microfossils incorporated in its mass.

The rhyolite varied in color but maintained a basic texture of crystals of feldspar embedded in a mass of finer grains. Colors varied from pinks to gold or tans. One projectile point fragment from Site 41SR271 is chipped from an orange rhyolite with large feldspar crystals. This artifact is the only example of orange rhyolite observed during the survey. Rhyolite is occasionally seen in the form of thick bifaces as well.

Less common are rocks containing large amounts of chalcedony. One core fragment composed of large crystals of light blue chalcedony with iron oxide staining was found on Site 42SR285. Small amounts of palmwood also occur as well as a dark, nearly black limestone.

Observed artifacts are most commonly made from the locally available flints. Large bifaces (choppers or hand axes) chipped from rhyolite or some similarly coarse-textured material were also noted. Smaller tool types are chipped mainly from fine textured (aphanitic) material.

Historic Sites

A total of nine sites containing evidence of historic occupation was recorded during the survey. All of these sites exhibited evidence of possible prehistoric components as well. The separation of the prehistoric from the historic was not possible from surface investigations in these cases because of the mixing effect various erosional forces have on the sites.

Three of the nine sites contained structures attributed to historic European occupation. All of the structures were built of roughed-out sandstone blocks, plastered over and whitewashed. On Site 41SR280, the three structures were still roofed with thatching, and the walls were well-plastered. Historic research indicated that this site had been occupied by the Gonzalez family until 1950 when the construction of Falcon Dam was impending. The family abandoned the site out of fear that the dam would break. At least one member of the family that occupied the site is still alive and dates the construction of the structure to about the mid-nineteenth century (Bruce Sanders 1975: personal communication). Examination of the artifacts indicate that the site dates back to at least 1870 and possibly earlier (Fig. 9).

The two remaining sites with evidence of structures (Sites 41SR290 and 41SR293) have been abandoned for a much longer time. The roofing is gone, and the structures are undergoing decay and collapse. The plaster is apparent only in patches. Both of these sites have been given names by the local inhabitants, and one is indicated on the U.S.G.S. topographic map entitled Roma-Los Saenz West, Tex.; however, no previous record of these sites can be found in either the archeological site file at The University of Texas at Austin or in the Texas Historical Commission county file. From a cursory examination of the artifacts, these sites appear to date from the mid-nineteenth century although further research may reveal an earlier historic occupation.

The larger of the two remaining historic sites is locally called Casas Blancas (41SR293), consisting of five structures and a small cemetery. Relatively little modern debris is present on the site, but the stone-covered graves and grave crypts show evidence of having been cared for at some time in the recent past. At least two, and possibly three, graves have been disinterred, presumably having been moved to a more accessible cemetery (Figs. 10, 11, and 12).

The other site is called Casa Yankee (41RS290) and has some interesting rumors surrounding it. Two informants claim the site was a saloon and low river crossing (Florence Scott and George Bowle 1975: personal communication). At least three structures and evidence of a fourth occur on the site. The structures are of the same sandstone construction as the other two sites. Artifacts indicate that the site could have been inhabited as early as 1820, but the bulk of datable artifacts suggests an occupation in the 1840s or 1850s. The extent of the occupation is unknown; however, abandonment apparently took place after the killing of several members of the families in residence due to a feud (Florence Scott 1975: personal communication). At the edge of Site 41SR290 is a prehistoric component site. Since it appeared that the mixing of artifacts was a result of erosion and the main part of the prehistoric component was at a

FIGURE 9
Stone house with thatched roof and plastered walls on Site 41SR280.

FIGURE 10
Stone house on 41SR293.

FIGURE 11
Disinterred grave on Site 41SR193.

FIGURE 12
Stone grave crypt on Site 41SR293.

higher elevation, the site (41SR291) was recorded separately. Further work is needed to clarify the mixed nature of historic and prehistoric components.

The six sites displaying historic occupation without accompanying structures have all suffered from the mixing of artifacts that has resulted from erosion. At least two of the sites are good candidates for further work to determine if historic Indians could have occupied them temporarily. These sites (41SR266 and 41SR268) yielded a variety of ceramic artifacts, some of which look like Indian ware strongly influenced by Mexican techniques, and many flint artifacts. Since pottery is not a common occurrence in prehistoric sites along the Rio Grande in the region of Starr County, research in the sites which suggest close association between the Europeans and the aboriginal natives of the area could aid in the documentation of cultural change during the historic period. No small projectile points (arrowpoints) were found at either of these sites.

The remaining four historic sites are shallow, eroded areas littered with ceramic, glass, and a small amount of metal artifacts intermingled with flint debris. Some areas of these sites are still intact and could be tested; however, the occupation debris is of low density and of small horizontal extent. Because of the widespread practice of dumping garbage in the dry arroyos, some of the historic artifact scatter could be secondary, that is, deposited by runoff after a heavy rain. Another possibility is that these occurrences of historic artifacts could represent residual scatter from larger sites. A more intensive and complete survey is necessary to determine the situation.

It is obvious from the literature, as well as the present reconnaissance, that the study area has undergone continuous settlement by prehistoric and historic inhabitants. Cultural refuse occurs virtually everywhere and separation of sites is complicated. The present reconnaissance was limited by time; therefore, only a catalog of sites can be presented. However, even with the briefest of investigations, it is clear that the area could provide considerable data on the cultural changes taking place at the time of historic entry.

SUMMARY

When the reconnaissance was begun, it was hoped that sufficient research could be accomplished to present some cohesive idea of prehistoric and historic settlement in the area. As the complexity of the archeology in the study area became more apparent, this goal, for purposes of this brief reconnaissance, was abandoned. The aim then was modified to a simple reconnaissance designed to produce a catalog of sites, general description of the variations evident through a cursory examination, and recommendations for further work.

After a comprehensive investigation of the literature on the prehistory of south Texas, it seems clear that the homogeneous monotony attributed to the cultures of this area is an error in judgment. Numerous recent references indicate a cultural diversity heretofore unrecognized, and the future promises many more such revelations. The study area is in a particularly good position for research as it lies between the Falcon Reservoir and the larger tributaries (Arroyo Los Olmos principally, but also Arroyo Los Morenos and Garcias Creek) further downstream. These two areas have received considerable archeological attention in the past. If research could be directed with the idea of linking the two areas and producing a cogent well-documented cultural scheme for that portion of the Rio Grande, the archeological information concerning south Texas would be greatly enhanced.

Historical settlement has been fairly intensive and of considerable temporal extent, originating in Spanish-Colonial times. Research of the historic settlement in this area could result in a better understanding of the life styles of these early settlers and their descendants.

RECOMMENDATIONS

On the basis of the survey and examination of the available literature on the archeological resources of the Rio Grande Plain, recommendations were compiled for the benefit of follow-up work that we hope will take place in the near future. It was obvious before the survey that the study area has received virtually no professional investigation. Areas surrounding the immediate survey locale had been investigated, including the Arroyo los Olmos drainage and the Falcon Reservoir area. As an initial step, the survey area should be studied in order to provide full coverage of this section of the Rio Grande Plain.

The most immediate action that should be taken is to stabilize the sites by allowing grassy vegetation to grow in place of the brush. Unless this is done, the sites will gradually be eroded away, resulting in loss of important archeological data as well as soil.

Secondly, an intensive survey and testing program should be undertaken in the areas that were not reached during the present reconnaissance. Systematic controlled surface collection should be practiced, and in-depth analysis should be pursued. Because of the eroded nature of many of the sites, techniques similar to those used by Emma Lou Davis in China Lake, California, may prove fruitful (Davis

1975:39-53). Special consideration should be given to high elevation areas for possible buried Paleo-Indian sites. The riparian zones should be carefully examined for evidence of the Neo-American or Late Prehistoric stage, heretofore undiscovered along the Rio Grande in Starr County. Historic aboriginal sites should be sought in order to clarify the relationships between the settlers and the aborigines in early Spanish-Colonial times and to document the raiding period of the 1830s when the Plains tribes were in the area.

Local collections should be examined to record the tool types found in the area by amateurs and possibly to augment the professionally collected materials. Attempts should be made to educate the public about the goals of archeological research through displays, lectures, and tours.

Historical documentation studies should be pursued, taking advantage of the fact that many descendants of the early settlers still live in the area and may have considerable unpublished data on the early historic settlement. Research of old maps showing the area should be done in order to formulate historic settlement patterns. Unpublished documents describing Indian and early European traits may still exist, and these should be unearthed for any specific information they may yield.

Attempts at paleoenvironmental reconstruction should be undertaken and the results linked to cultural manifestations, if possible. Some historical documentation of vegetational changes exists; however, no source adequately pulls these works together in a cohesive account.

Most importantly, the interdisciplinary approach originally attempted in this study should be continued. The various sciences involved should coordinate their research so that the most detailed and informative research is accomplished. Only by combining the expertise of many fields can a geographical area with its many variations and complexities be thoroughly understood.

Site 41SR-	Elev. in Ft.	Prehistoric	Prehistoric-Historic (Mixed)	Prehistoric Occupation Site	Prehistoric Quarry Site	Historic w/ Structures	Historic w/o Structures
263	220	X		X			
264	220		X				X
265	200-210	X		X			
266	200-210		X				X
267	225		X				X
268	200		X				X
269	240	X		X			
270	210	X		X			
271	230		X				X
272	230	X		X			
273	230	X		X			
274	230	X		X			
275	250	X		X			
276	250	X		X			
277	200	X		X			
278	230	X		X			
279	250	X		X			
280	200		X			X	
281	220-230	X		X			
282	220	X		X			
283	200	X		X			
284	210-240	X			X		
285	250	X			X		
286	210	X		X			
287	210	X		X			
288	210	X	Intrusive	X			
289	200-210	X		X			

REFERENCES

Bandelier, Fanny (translator). 1904. *The journey of Alvar Nunez de Vaca and his companions from Florida to the Pacific, 1528-1536.* Allerton Book Company, New York.

Blair, W. Frank. 1950. The biotic provinces of Texas. *The Texas Journal of Science* 2(1):93-117.

———. 1952. Mammals of the Tamaulipan biotic province of Texas. *The Texas Journal of Science* 4(2):230-250.

Bogusch, Edwin R. 1952. Brush invasion in the Rio Grande Plain of Texas. *The Texas Journal of Science* 4(1):85-91.

Byfield, Patsy Jeanne. 1966. *Falcon Dam and the lost towns of Zapata.* Texas Memorial Museum Miscellaneous Papers, Number 2, Austin.

Campbell, T. N. 1973. A critical review of Cabeza de Vaca's account of aboriginal groups in southern Texas, 1528-1536. Paper presented at the 1973 annual meeting of the Spanish Borderlands Conference.

———. 1974. The American Indian in South, Texas 1527-1850. Paper presented at the 1974 quarterly meeting of the Southern Texas Archaeological Association, Corpus Christi.

Cason, J. F. 1952. Report on archaeological salvage in Falcon Reservoir, season of 1952. *Bulletin of the Texas Archeological and Paleontological Society* 23:218-259.

Chandler, C. K. 1974. Use wear analysis of "Clear Fork" tools from the Falcon Reservoir area, southern Texas. *La Tierra* 1(4):15-21.

Covey, Cyclone. 1961. *Cabeza de Vaca's adventures in the unknown interior of America.* Collier Books, New York.

Davis, Emma Lou. 1975. The "exposed archaeology" of China Lake, California. *American Antiquity* 40(1):39-53.

De Leon, Alonzo. 1905. Relacion y discursos del descubrimiento, poblacion y pacificacion de este Nuevo Reino de Leon (1649). In Documentos ineditos o muy raras para la historia de Mexico. Edited by G. Garcia. Mexico.

Duaine, Carl L. 1971. *Caverns of oblivion.* Packrat Press, Manchaca, Texas.

Epstein, Jeremiah F. 1969. *The San Isidro site, an early man campsite in Nuevo Leon, Mexico.* Anthropological Series 7, Department of Anthropology, The University of Texas at Austin.

———. 1975. Some reflections on the nature of northeast Mexico lithic tradition and the problem of its origin. Paper presented at the Reunion sobre Aspectos de Arqueologia e Historia del Noreste. Sponsored by the Instituto Nacional de Antropologia e Historia and the State of Nuevo Leon, Monterrey.

Hartle, Donald D., and Robert L. Stephenson. 1951. *Archeological excavations at the Falcon Reservoir, Starr County, Texas.* River Basin Surveys, Smithsonian Institution.

Hester, Thomas Roy. 1967. Notes on the distribution of the Plainview type in southwest Texas. *News bulletin of the South Plains Archeological Society* 14:3-8.

———. 1968. Folson points from southwest Texas. *Plains Anthropologist* 13(40): 117.

———. 1970. Metal projectile points from southern Texas. *The Record* (Journal of the Dallas Archeological Society) 27(2):9-11.

———. 1972. Toltec artifacts from southern Texas. *The Masterkey* 46(4):137-140.

———. 1973. *Hunters and gatherers of the Rio Grande Plain and lower coast of Texas.* Revised version of paper presented at the 1971 annual meeting of the Texas Academy of Science, Nacogdoches.

———. 1974. On fluted points and Texas archeology. *Texas Archeology* (Newsletter of the Texas Archeological Society) 18(2):11-14.

———. 1975a. *A chronological overview of prehistoric southern and south-central Texas.* Paper presented at the Reunion sobre Aspectos Arqueologia e Historia del Noreste. Sponsored by the Instituto Nacional de Anthropologia e Historia and the State of Nuevo Leon, Monterrey.

———. 1975b. Chipped stone industries on the Rio Grande Plain, Texas: some preliminary observations. *The Texas Journal of Science* 26(1-2):214-222.

Hester, Thomas Roy, Gilbow, Delbert, and Albee, Alan D. 1973. A functional analysis of "Clear Fork" artifacts from the Rio Grande Plain, Texas. *American Antiquity* 38(1):90-96.

Hester, Thomas Roy, Hill, T. C , Jr , Gifford, Diane, and Holbrook, Sally. 1975. Archaeological salvage at site 41ZV152, Rio Grande Plain of Texas. *The Texas Journal of Science* 26(1-2):224-228.

Hester, Thomas Roy, and Kohnitz, H. 1975. The chronological placement of "Guadalupe" tools. *La Tierra* 2(2):22-25.

Hoffman, David. 1972. *Roma.* A Texas Historic Resources Fellowship sponsored by the San Antonio Conservation

Society and administered by the Texas Architectural Foundation.

Holden, W. C. 1924. *Fray Vicente Santa Maria: historical account of the colony of Nueva Santander and the coast of Seno Mexicano.* Master's thesis, The University of Texas at Austin.

Hughes, J. T. n.d. *Proposal for historical studies in connection with the Falcon Reservoir area.* Ms. on file, The University of Texas at Austin.

Inglis, Jack M. 1964. *A history of vegetation on the Rio Grande Plain.* Texas Parks and Wildlife Department, Bulletin No. 45. Austin.

Jelks, Edward B. *Chronology of the Diablo Range in southern Texas and northeastern Mexico.* Paper presented at the Reunion sobre Aspectos Arqueologia e Historia del Noreste. Sponsored by the Instituto Nacional de Antropologia e Historia and the State of Nuevo Leon, Monterrey.

Johnson, Elmer H. 1931. *The natural regions of Texas.* The University of Texas at Austin: Bureau of Business Research, Research Monograph No. 8.

Johnson, LeRoy, Jr. 1964. *The Devil's Mouth site: a stratified campsite of Amistad Reservoir, Val Verde County, Texas.* Archaeology Series No. 6. The University of Texas at Austin: Department of Anthropology.

Krieger, Alex D. 1954. *A radiocarbon date on the Falcon focus.* Bulletin of the Texas Archeological Society 25:565.

Krieger, Alex D., and Hughes, Jack t. 1950. *Archaeological salvage in the Falcon Reservoir area: progress report no. 1.* Austin: National Park Service and The University of Texas. Memo on file at the Texas Archeological Research Laboratory.

MacNeish, Richard. 1958. *Archeological investigations in the Sierra de Tamaulipas, Mexico.* Transactions, American Philosophical Society 48(6).

Maxwell, Ross A. 1970. *Geologic and historic guide to the state parks of Texas.* The University of Texas at Austin: Bureau of Economic Geology Guidebook 10.

Mitchell, J. L. 1974. Notes on metal projectile points from south Texas. *Journal of South Texas* 1:47-51.

Newcomb, William W., Jr. 1961. *The Indians of Texas.* University of Texas Press, Austin.

Newton, N. B., Jr. 1968. The distribution and character of sites, Arroyo los Olmos, Starr County, Texas. *Bulletin of the Texas Archeological Society* 38:18-24.

Nunez Cabez de Vaca, Alvar. 1907. The narrative of Alvar Nunez Cabeza de Vaca. In *Spanish explorers in the southern United States.* Edited by Frederick W. Hodge. Charles Scrivners Sons, New York.

Nunley, Parker. 1971a. Archaeological investigation and the particularistic model: the Coahuiltecan case. *Plains Anthropologist* 16(54):302-310.

———. 1971b. Sociocultural units of the southwestern Texas Archaic: an analytic approach. Ph.D. dissertation, Southern Methodist University, Dallas.

Nunley, Parker and Hester, Thomas R. 1975. *An assessment of archaeological resources in portions of Starr County, Texas.* Center for Archaeological Research. The University of Texas at San Antonio: Archaeological Survey Report, Number 7.

Reeve, Frank D. 1946. The Apache Indians in Texas. *Southwestern Historical Quarterly* 50(2):189-219.

Ruecking, Frederick R., Jr. 1953. The economic system of the Coahuiltecan Indians of southern Texas and northeastern Mexico. *The Texas Journal of Science* 5(4):480-497.

———. 1954a. *Bands and band-clusters of the Coahuiltecan Indians.* Student papers of Anthropology 1(2). Department of Anthropology, University of Texas at Austin.

———. 1954b. Ceremonies of the Coahuiltecan Indians of southern Texas and northeastern Mexico. *The Texas Journal of Science* 6(3):330-339.

———. 1955a. The Coahuiltecan Indians of southern Texas and northeastern Mexico. Master's thesis, University of Texas at Austin.

———. 1955b. The social organization of the Coahuiltecan Indians of southern Texas and northeastern Mexico. *The Texas Journal of Science* 7(4):357-388.

Scott, Florence Johnson. 1969. *Royal land grants north of the Rio Grande, 1777-1821.* Texian Press, Waco, Texas.

Sellards, E. H. 1940. *Pleistocene artifacts and associated fossils from Bee County, Texas.* Bulletin of the Geological Society of America 51.

Shafer, Harry J. and Baxter, Edward P. 1975. *An archeological survey of the lignite project, Atascosa and McMullen counties, Texas.* Anthropological Laboratory, Texas A&M University, Report No. 7.

Skeels, Lydia Lowndes Maury. 1972. *An ethnohistorical survey of Texas Indians.* Austin: Office of the State Archeologist Report 22, Texas Historical Survey Committee.

Sollberger, J. B., and Hester, T. R. 1972. The Strohacker site: a review of Pre-Archaic manifestations in Texas. *Plains Anthropologist* 17(58):326-344.

Sorrow, William M., Shafer, Harry J. and Ross, Richard E. 1967. *Excavations at Stillhouse Hollow Reservoir.* Papers of the Texas Archeological Salvage Project, No. 11. The University of Texas at Austin.

Suhm, D. A., Krieger, A. D. and Jelks, E. B. 1954. *An introductory handbook of Texas archeology.* Bulletin of the Texas Archeological Society 25.

Swanton, John R. 1940. *Linguistic material from the tribes of southern Texas and northeastern Mexico.* Washington, D.C.: Bureau of American Ethnology, Bulletin 127.

Thompson, Jerry. 1974. *Sabers on the Rio Grande.* Presidial Press, Austin.

Troike, R. C. 1959. Researches in Coahuiltecan ethnography. *Bulletin of the Texas Archeological Society* 30:301-309. Austin.

———. 1961. Notes on Coahuiltecan ethnography. *Bulletin of the Texas Archeological Society* 32 (for 1961):57-63. Austin.

Trowbridge, A. C. 1932. *Tertiary and quaternary geology of the lower Rio Grande region, Texas.* United States Department of the Interior Geological Survey Bulletin 837.

Vigness, David M. 1955. Indian raids on the Lower Rio Grande, 1836-1837. *Southwestern Historical Quarterly* 59(1):14-23.

Vigness, David M. (editor, translator). 1972. Nuevo Santander in 1795: a provincial inspection by Felix Calleja. *Southwestern Historical Quarterly* 75(4):461-506.

Weir, Frank. 1956. Surface artifacts from La Perdida, Starr County, Texas. *Bulletin of the Texas Archeological Society* 27:59-78.

RIO GRANDE-FALCON THORN WOODLAND

A NATURAL AREA SURVEY
NO. 13

Lyndon B. Johnson School of Public Affairs
The University of Texas at Austin
1976

RIO GRANDE-FALCON THORN WOODLANDS

STARR COUNTY, TEXAS

AREAS SUBJECTED TO ARCHEOLOGICAL RECONNAISSANCE

Survey Areas

BASE FROM USGS FALCON VILLAGE, ROMA, AND SALINEÑO 7½' QUADRANGLE MAPS

SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET

DOTTED LINES REPRESENT 5-FOOT CONTOURS

DATUM IS MEAN SEA LEVEL

UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

RIO GRANDE-FALCON THORN WOODLANDS

STARR COUNTY, TEXAS

MAJOR PLANT ASSOCIATIONS

- Chaparral Association
- Fresno – Saúz Association
- Mesquite – Granjeno Association
- Cleared Areas

FALCON RESERVOIR

Falcon Village

Falcon Heights

Salineño

RIO GRANDE

TAMAULIPAS

MEXICO

BASE FROM USGS FALCON VILLAGE, ROMA, AND SALINEÑO 7½' QUADRANGLE MAPS

SCALE 1:24000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 10 FEET

DOTTED LINES REPRESENT 5-FOOT CONTOURS

DATUM IS MEAN SEA LEVEL

UTM GRID AND 1985 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

TEXAS

QUADRANGLE LOCATION

RIO GRANDE-FALCON THORN WOODLANDS

STARR COUNTY, TEXAS

Photogeologic Map

Dwight Deal

Age	Unit	Explanation
Quaternary	Qfp	Lower floodplain and channel deposits; gravel, sand, silt, and clay: commonly inundated by high water
	Qs	Slope and sidestream deposits; mostly clay, silt, and fine sand with some gravel: colluvium and alluvium
	Qt	Higher floodplain and younger terrace deposits; silt, sand, and gravel with some clay: subject to occasional flooding at times of very high water
	Qtg	Older terrace gravels
Tertiary	Tc	Dominantly clay and shale: mostly Yegua Formation
	Ts	Dominantly sands and sandstone with some clay: mostly Crockett Formation

Spot Occurrances

S Sandstone outcrop or reddish sandy soils

C Clay outcrop or dark clay soils

G Gravel

Contact Reliability

———— Located with less than 0.1 km error; physically located on the ground and easily traced on air photos

— — — — May have up to 0.3 km error in location; traced on air photos only

—?—?— Approximate or arbitrary location, may be mislocated 0.3 km or more; contact not located on ground and difficult or impossible to follow on air photos

UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

BASE FROM USGS FALCON VILLAGE, ROMA, AND SALINEÑO 7½′ QUADRANGLE MAPS

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 10 FEET

DOTTED LINES REPRESENT 5-FOOT CONTOURS

DATUM IS MEAN SEA LEVEL

TEXAS

QUADRANGLE LOCATION